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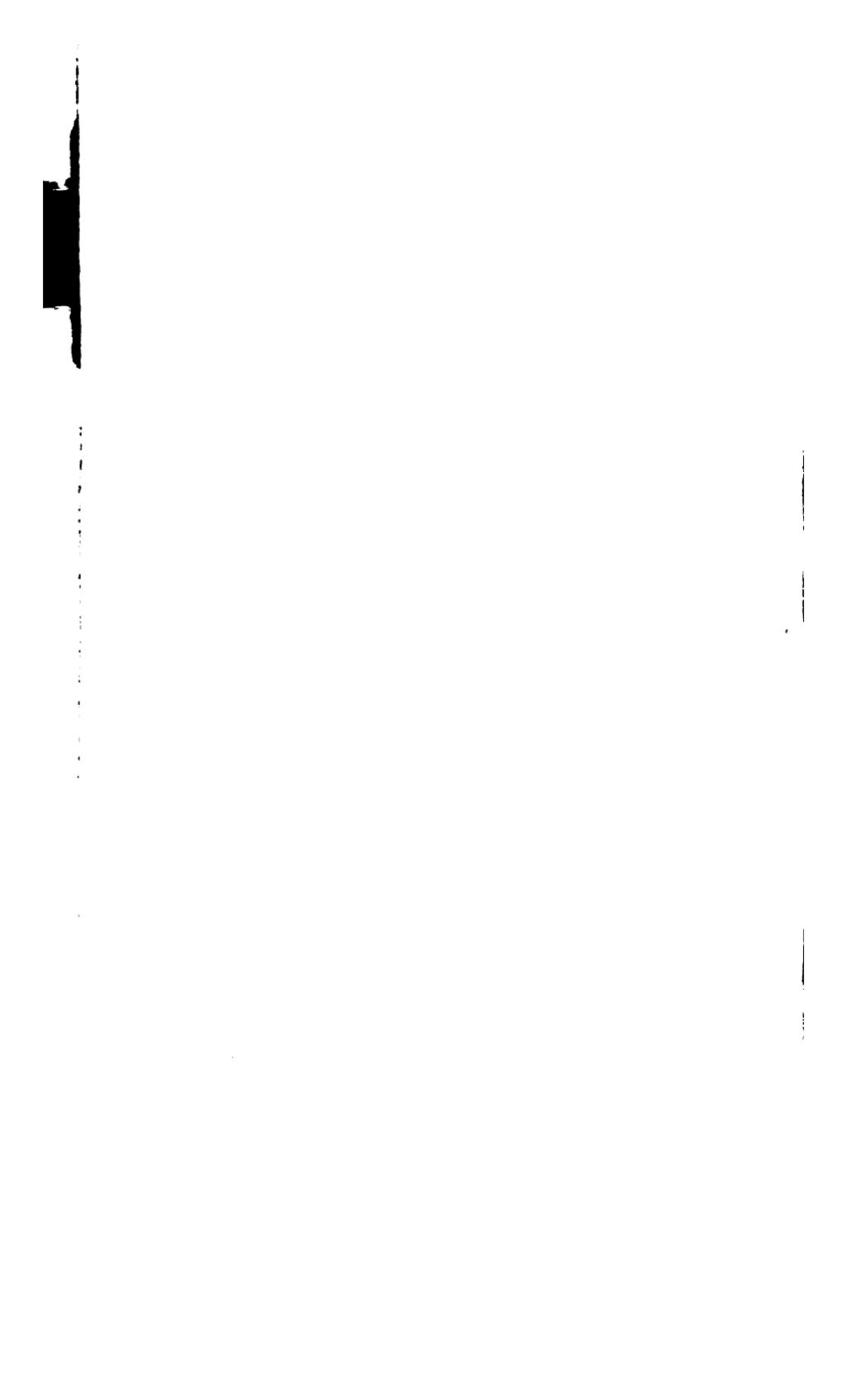


Geo Duffield

Section

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THE
STATE
OF
NATURE
OR
INSTINCTS.
WITH A
TREATISE
ON
MINING.
AND
OBSERVATIONS in 1706.

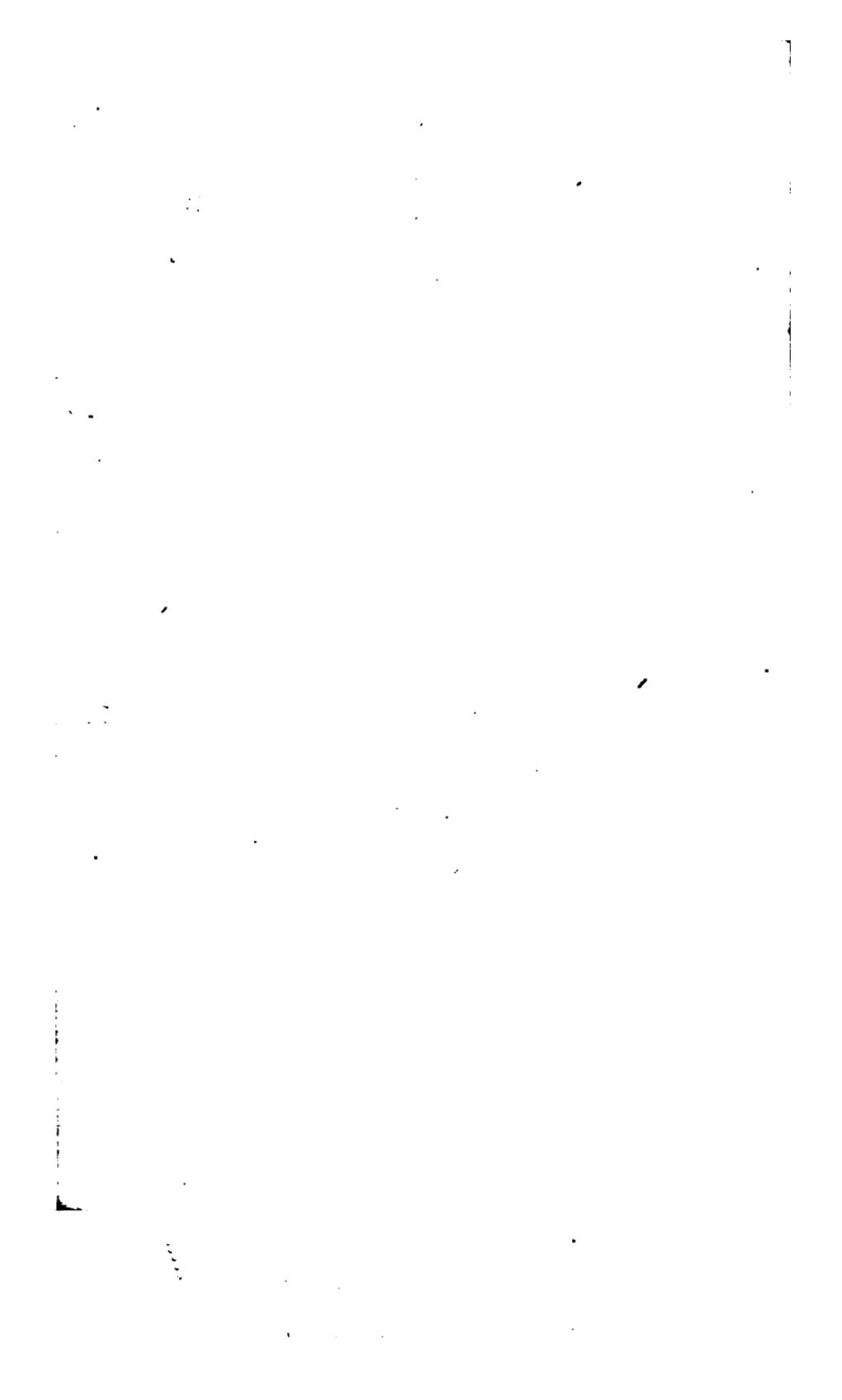
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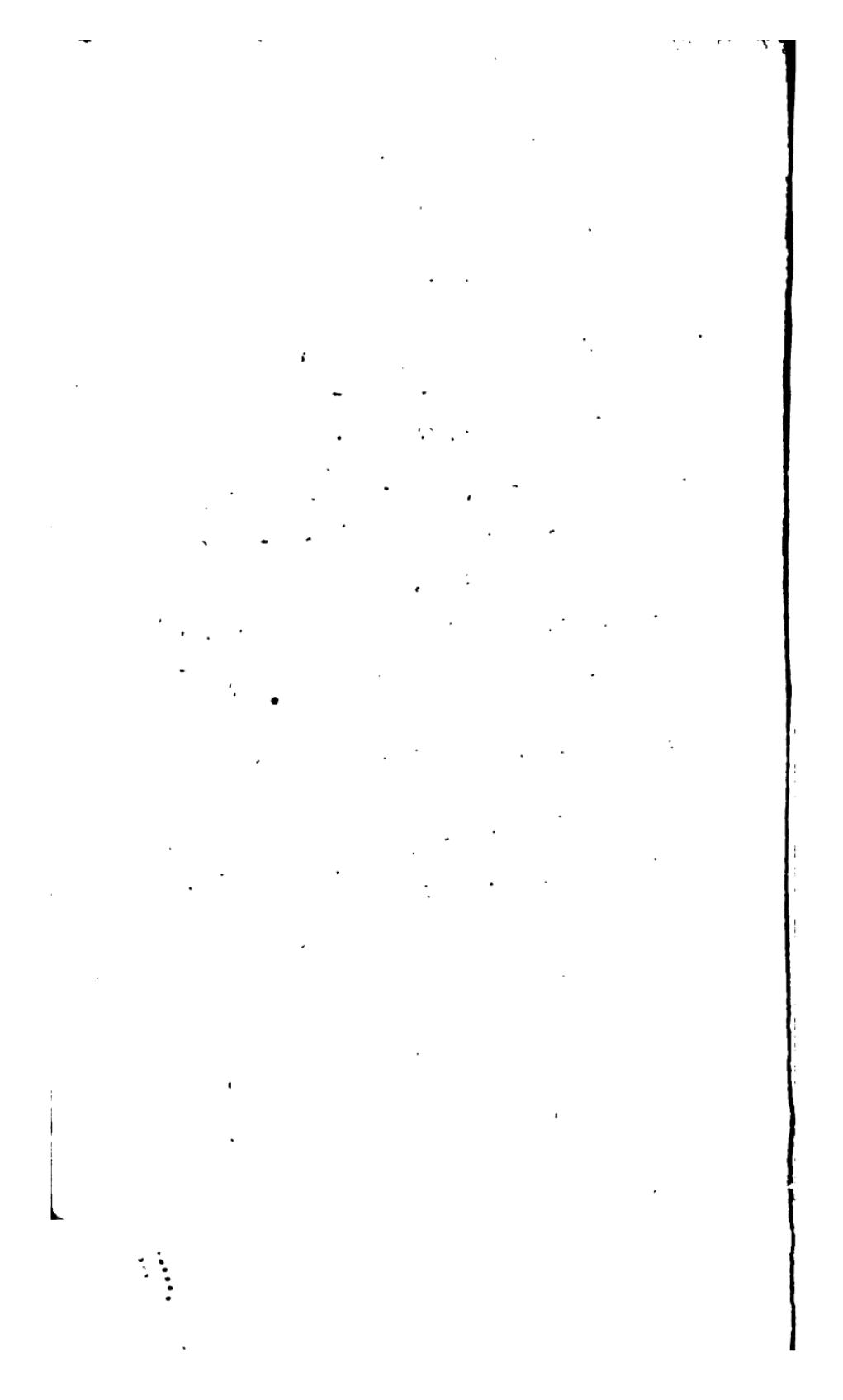
1749.



T H E
S T A T E
O F
N A T U R E;
O R,

The Manner in which God created and adapted the constituent Corpuscles, the Manner of their Constitution, the Quantity, Situation, &c. of every thing; and the Figure, Size, Numbers, Parts, Infinits, Abilities of every Sort of Creatures, and the Order in which He designed Man, and every thing in the Creation, should act.

Taken from the Original Manuscript of
JOHN HUTCHINSON, Esq;



*Gift
Tappan Piob. Assoc.
3-22-1933*



THE
STATE
OF
NATURE, &c.

MA NY ingenious Men have made particular Observations of the Earth and Elements, of it's Product, and of the Tribes of Creatures, single Creatures, and Parts; how the Earth, and the several Elements, produce Necessaries and Conveniences for Man, and each Animal, &c. how several Sorts of Creatures are fitted with Parts, Instincts, &c. for their Manner of Feeding, Generation, and Growth, &c. and Mr *Derham* has made a vast Collection, with

VOL. XII.

B

Additions

Additions, to those Observations, which affords Matter of Admiration; but has not shewed how several Things, Situation of Things, and Creatures, are useful to Man; nor scarce at all mentioned, that any of them are adapted to the Use of Men only in Society, nor shewed how the Instincts of Brutes are adapted for the Service of Men in Society; nor how the Instincts of Men differ from those of Brutes, nor how these Differences in Instincts in Men from Brutes are adapted for Society, nor how Society is adapted to answer the End of Man's Creation; which, if clearly described, would not only afford many great Subjects for Admiration, but for Gratitude and Love to the great Creator and Contriver of that Scheme so beneficial for Man.

I intend not in this Sketch to enter into Particulars, but to recite in general what they have taken Notice of, or what may occur in Course, and make some Applications which they have not made.

The Atheistical Arguments are founded upon a Supposition that Things are not disposed in proper Order for the Good of Man, but that some are for his Good and some for his Hurt, and therefore that all Things happened by Chance.

The

The Arguments of the Libertines are founded upon a Supposition that each Person is born free, and left to his own Reason and Choice, &c.

The Discontents of many well meaning Christians, arise from a false Notion ; that as we are in a fallen State, God has ordered every Thing to be a Punishment to us, and put us under severe Laws and hard Conditions of Salvation ; to shew the contrary, that in Truth he has adapted every Thing for our Benefit in the State we are in, and that his Laws are adapted to the Nature of Things, and such as we ourselves should choose to be governed by, if we understood our own Condition, is the Design of these Lines.

God created this Globe and it's Appurtenances, for a Nursery to raise up Plants to be transplanted into his Celestial Garden, or Paradise above ; or for a Colony to breed up and discipline Subjects for his Imperial City, or Celestial Empire.

God foresaw what Things, and what Quantity, and what Disposition of each Sort of Things, would be necessary for the Good of the Race of Men, at the several Times, and in their several Conditions, during their several States ; and every Thing that was made, was good,

any Inconveniency they have been, or will be at, at other Times.

God created the Earth of such Magnitude, and compos'd of such different Sorts of Matter, dispos'd and plac'd the Parts of those several Sorts of Matter, fram'd the Sea of such Extent, compos'd of such Mixtures of Salt, Waters, &c. made the Outlets like Water-Pipes under Ground to the several Parts of the Earth, and the Returns in Channels and Rivers above, either at the Creation or in the Flood, and plac'd the whole at such Distances from the Sun, made the Heat and Light of such a due Force, and enclos'd it with such a due Thickness and Pressure of Atmosphere, gave each Part such Motion, such Proportion of Gravity, and other Properties, made each Part of such Sizes, Figures, &c. to expand, contract, unite, and operate upon other Parts, made the Frosts and Rains dissolve the Surface of the Earth, and prepare it for yielding vegetable Matter; and the Heats raise that Matter, that the whole should afford such Materials, produce such Products; some for the Use of Beasts, Birds, and Insects; some for the Use of Man, and some for the Use of both, as should be fit for maintaining, and

and require so much Labour and Skill in procuring, and fitting those Materials and Products, as should be fit for employing, the Race of Men, suitable to their small Numbers, and little Knowledge at first ; and to their greater Numbers, as they should increase in Numbers, Knowledge, Invention, Industry, Extravagancies, &c. What Alteration was made at the Flood, in the Parts of the Earth, in the vegetable Matter, in Stones, Minerals, &c. In the Extent of the Sea, in the Proportion of the Salt to the Water, &c. I shall not meddle with here.

God, doubtless, made the whole Surface of the Earth (Paradise distinguish'd) produce Gras, Herbs, Trees, each Plant, Tree, &c. compos'd of proper Corpuscles, and properly combin'd ; and each Sort of proper Shapes, Sizes, &c. for their Uses, each Sort in the Climate proper for them ; and in each Climate, each Sort, in the Soil, Situation, &c. proper for that Sort to grow in, where it's Roots might gather a proper Quantity, or proper Corpuscles for it's Composition ; and proper for the Use of Creatures, proper for, and the Inhabitants of, that Climate, Soil, &c. In short, made it produce Trees of proper Sizes, &c. for Timber,

ber, Utensils, &c. The Fruit Trees of such Heights, that they would preserve the Fruit from such Beasts as would have eaten it. The Underwoods, Shrubs, &c. of proper Sizes for Fences, Fuel, &c. The Plants which yield Fruit, Seeds, and other Necessaries for the Use of Man, of such Sizes, and in such Quantity, as would employ Men in cultivating the Ground, planting, sowing, gathering, and manufacturing them, and the Grafs of such several Sizes, and in such Disposition, that it would employ the Beasts of several Sizes that were to feed upon it, in gathering it, or Men in collecting it for them. Many Plants, or Weeds, which seem fit for no other Use, the Leaves of the Trees, &c. for Insects to breed in and feed upon, and gave each Sort the same Qualities, the same Method and Proportion of Growth, Increase, Duration, Decrease, and Method of renewing, or multiplying, either at the first, or at the Flood, which they have now. Whether the Vegetables were preserved at the Flood in the muddy Water, and rais'd from the Roots or Seeds in it, or reproduced after the Flood, whether they were casually preserved in some Parts, and the Seeds carry'd by Wind and Water from

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from Coast to Coast ; some spread over Land by the Winds, other carried by Birds which feed upon them ; others by such Creatures as Squirrels, Mice, &c. which hide them for Food, and so sow them. Or means have been used by Man to transplant them, each to their proper Climates and Soils, where each would grow and be useful as they are now found ; or whether the Species of some more wholesome, delicate, or useful Sorts of Fruits, Seeds, &c. were destroy'd at the Flood, or the vegetable Matter were dispers'd too much to sustain them, and were only left in Quantity sufficient to nourish the common Fruits, Plants, &c. in some Parts, and in others only to nourish Thorns, Furze, Heath, &c. I only quære here. But I think if some Sorts of Plants, Trees, &c. had not covered the Face of the Earth soon after the Flood, the Earth would have corrupted and become unwholesome.

God made the Earth, Seas, &c. produce Beasts, Birds, Reptiles, Insects, Fishes, &c. I think over the whole Surface, each Sort of proper Size and Shape, with proper Instincts, and with Parts of such Sizes and Figures, and placed their Parts in such Order, as were proper for the Places
of

of their Residence ; the Food they were to eat ; the Manner of procuring it ; the Places they were to procure it in, so that that they should not procure it too fast nor too slowly ; fitted them with Sight, Smell, and Taste, whereby they should pursue and choose their Food, as soon as they were created or produced, by the agreeable Sensation it made upon some of their Parts, and gave them Parts adapted to grow, Eggs, Spawn or Seed, with Instincts to couple, or mix their Eggs and Seed without coupling, as soon as they are fit to execute the parental Offices, and at proper Distances of Time, before the Assistance or Food for each of their Young will be ready in every different Climate. And those Instincts to vary those Times, or the Climates occasion a Variation in them, as the Creatures are shifted out of one Climate into another. And more remarkably in several of the tamer Sorts, which are to be kept in every Climate, and to pair only during the Time they are about coupling or mixing their Eggs and Seed, or till their young are able to provide for themselves, as the Necessity of the Dam or Young, from the Manner of procuring their Food, requires ; have different Manners of producing their Young alive,

alive, or by Eggs, Spawn, &c. in such Manner, that the Parents may be least hindered in their Manner of living, moving, and suited to the Places they live in. The Manner they procure Food, protect or hide their Young, &c. go different Times with Young, in the same Manner those who are to procure their Food, or to escape by running, flying, &c. a short Time, others longer, in Proportion to their State; to bring forth their young alive, or hatch their Eggs, or leave their Eggs or Spawn, that they may be brought to life at different Seasons, each when, and where their proper Foods will grow, breed or be ready. And those whose Parents are to make their Escape, or the Young to be hid when the Grafs or Corn is upon the Ground grown up, the Leaves of the Trees, &c. to breed different Numbers, according to the Means their Parents have, or the Provision Nature has provided for their Food, &c. The Young to be different Lengths of Time in being able to move, follow their Parents, or provide for themselves according to the means Nature has provided their Parents with to assist them, and the Occasion they have for Strength or Instruction to procure

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cure their Food, to escape those which feed upon them, &c. or the Means they are provided with otherways ; the old Ones to breed at different Distances of Time, suitable to the Time each sort of them are discharged of their Young, at least once a Year, when new Provision for their new Young returns. The Young of each to have different Times of coming to maturity for Use or Service, according to the Uses they are design'd for, and to live different Numbers of Days, Months, or Years, according to the Ends they were design'd for ; and adapted their Nerves and Parts, so that each should be incited by a secret Pleasure to do, and in doing their respective Duties. And as some were to be fed upon Grass, some upon Fruits or Seeds, some of them were to be Food for Men, some for the Service of Man ; some were to feed upon those Creatures which were for the Food or Service of Man, and some upon those which were neither for the Service nor Food of Men. And as all vegetable Bodies were to grow or increase by the Corpuscles of such Matter in the Earth, or of Vegetables, or other Bodies corrupted and all Animal Bodies from the Corpuscles of Vegetables or Animal Bodies, there-

therefore all Bodies for Nourishment or Food, were compos'd of dissolvable Parts, and fram'd to dissolve by other natural Agents, if not apply'd to their Uses; and as especially those Corpuseles, which were volatile would be noxious, there were infinite Numbers of Sorts of small Insects, Birds, Fish, &c. created and fram'd to breed in vast numbers yearly, some in a shorter Time; the smaller Sorts to breed upon the Leaves of Trees, useless Weeds, &c. and to gather up, what would, if let alone, be obnoxious to Man, or in the Earth, Airs, Seas, Rivers, &c. The larger Sorts of Insects, the Birds and Fishes to gather up them, and so in Proportion, till they were at last all gathered up for Food, by those which are for Food or Service of Man, so that nothing is lost, nothing destroy'd, nothing impoverished, nothing suffered to be prejudicial; and fram'd the Parts, Abilities, and Tempers of each Species of those several Ranks of Creatures, answerable to those of other Creatures they were to keep Company with, to those they were to feed upon, and to those which were to feed upon them; and to the Strength and Knowledge of Man, which was to take some for Food, protect some Sorts,

Laws here, nor Punishment hereafter ; composed of two Parts, Angelick and Corporeal united ; the Angelick fitted with Powers for Reasoning, Contemplation, &c. to act like a little God within his little Sphere ; invisible to any other Being besides the great God, with Power to consult itself what is most fit to be done, and to move or direct the Motions of the Parts of his little World without visible Means ; and so we can only judge of the Abilities of that Part by it's Operations. Whether there be some Instincts in the Soul to love the great Creator, or to Knowledge, &c. or whether they follow naturally by Deduction from right Reasoning, will be considered afterwards.

And the corporeal Part, endowed with Instinct, or what you please to call that common to Brutes, and with Passions which flow from those Instincts, and are also common to Brutes, and fitted with Parts and Organs to procure Necessaries to keep it in Repair, to generate, to assist one another, &c. and they were to act together under Laws and Restraints during their State of Probation.

And framed that Part of the Earth called Paradise, fit for the first Pair to live in, which

which required little or no Labour to procure Necessaries, nor little or no Care but to feed themselves with what it naturally produced, fitted for them: Whilst they had no Duties except Homage and Thanks to their Creator, nor Restraint, except forbearing to eat of the Fruit of the Tree of Knowledge, or touching it; and whilst they had no Temptation nor Opportunity to break any of the Commandments given since, nor to seek for any Thing except Knowledge, and were only forbidden to attempt to attain it by eating that Fruit, had sufficient Time, and ought, if they wanted any useful Knowledge, to have acquired that useful Knowledge by Study and Contemplation, which was the only Thing they had to pursue; which, if they had pursued lawfully, would have heightened their Admiration of, and Love to, their Creator, and made them capable of that Happiness design'd for them.

If I might offer my humble Opinion, I think *Adam* and *Eve*, besides their Instincts (if they had any at first) had been taught, or had acquired sufficient Knowledge for their State, had Directions, because they had Means to instruct them; because they pleaded nothing in

abatement upon that Account, and because, as it happened, they were to instruct others ; and giving them that Commandment, was a Test or Trial, whether they, without bodily Labour, with such Knowledge, could keep themselves employed in the proper duties of the Mind, without seeking unnecessary or useless Knowledge ; and that it is written for a warning to their Race, to follow their respective Duties, and not seek for Impulse, or unnecessary Knowledge.

What Advantage Man had obtained if he had performed these Conditions, has not been fully revealed, and therefore I leave it to the Divines to reason about it. But after those Conditions were broke, Man was put upon another foot, whether the Instincts in Man and Woman were altered after their Fall, and adapted to their new State, and fitted for Society, or whether they are now as they were at first, I undertake not to determine. But their Bodies and Minds were both to grow and keep pace one with another, their Souls were to have no means of communicating Knowledge one to another, but by Instruction or Example, nor any means of acquiring it (except immediately from God) but by the joint Assistance

Assistance of their Bodies, and by comparing things transmitted to the Soul by their Senses. The Race of Man were to be compos'd of two Sexes of different Ages, and each Person, in a different Rank or Station, were to have different Capacities of Mind, and different Abilities of Body, and perhaps different Inclinations to this, or that Study, Employment, Labour, &c. Man was not, now, to eat the delicate Fruits and Herbs of Paradise, but to eat the Herbs of the Field, which would not be procured without Labour, and when procured would be far short in Goodness. Men were to live after different manners, feed upon different sorts of Food, wear different sorts of Habits, so that all sorts of Studies might be pursued, all sorts of Employments and Labour performed, all sorts of Food consumed, all sorts of Necessaries for Habits, &c. used. And they were to be under Laws and Restraints to one another, and from above, were to be under the government of their Parents whilst young, and under their chief Parent afterwards; were to live in Families and Societies, were to employ their minds in pursuit of Knowledge, Invention, &c. and their Bodies in Labour, to procure Necessaries and Conveniences;

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were to use their Instincts, Passions, or Inclinations, to provide for their well being, and for Procreation, Education, &c. according to Rules and their Affections, such as Conjugal, Paternal, Filial, Fraternal, Servial, and Political, to answer all the ends of Families and Societies, and were obliged to be just, merciful, and kind; so that, as they were to be of different Ages, of different Capacities of Mind, and different Strength of Body, they might each have opportunity in their several Stations, to exercise social Virtues, and assist each other in procuring each, Necessaries and Conveniencies, and in improving Knowledge, Divine and Human. Indeed at first it was necessary, that the Life of Man should be very long, that the first Parents might instruct their Race, and each Parent their Children, before their Fore-fathers had acquired sufficient Knowledge to instruct them, that they might gain it by their own Experience. But the Life of Man was afterwards (as their Numbers, means of attaining Knowledge, &c. have increased) by degrees shortned, and adapted to depend upon his Parents and Tutors, till he be instructed, afterwards to live till his Children were educated, instructed, &c. till

till he might have an opportunity to perform all the social Duties; and after that, by the decay of his Body, to bring his mind to Submission, Contemplation, &c. The parts of their Bodies, the length of their Infancy, the necessity they have for Food, Clothing, Instruction, &c. were all adapted for being educated in Society; their Hands were to procure what they wanted; their Minds were to direct, and their Tongues were to instruct, others; and every part of Body and Mind were to be employ'd in every part of their Lives in social Duties. Every sort of necessary Science was to be first discovered with great difficulty, and to be communicated by some, and understood by others, with much Time and Labour; and every thing was contrived to be procured with such a degree or proportion of Labour; and most things by the joint Labour of many, to afford them Necessaries to keep their Bodies in repair; so that some might employ their Minds and Strength to govern; some (I may say some few) whose Minds were endowed with Intellects, and their Bodies with Organs to reason, invent, dictate, and instruct, might instruct; and many to Labour pursue those Dictates, &c. And some for their Incapacity, whilst

young, were to be maintained and instructed; and others, for want of Abilities, or for want of Strength in old Age, were to be maintained without Labour, or other present advantage to the rest; so that the Government of some, the Knowledge of others, and the Labour of others, was to contribute to the Good of all. If the Angelick Part governed the Corporeal Part, exercis'd it's own natural Functions, kept the Instincts and Inclinations of the Body, within the lawful Rules for procuring Necessaries for keeping it in repair, for Propagation, &c. and directed the effects of those Instincts, it's Passions, as Love, Hatred, Desire, Aversion, Fear, Anger, &c. to their proper Objects, according to the Laws of Nature since revealed, or rather explain'd in the several Dispensations, it has pleas'd God to reveal, that that Agent, which the Atheists call Chance, shall, after the Death of the Body, and Dissolution of the Parts at the last Day, jumble, as they call it, the Atoms of our Bodies together again; and after the two Parts have been separated, they shall be united and advanced to an Angelick State. If the Corporeal Part prevail, and seduce the Angelick Part to Disobedience, to fix it's inclinations on wrong

wrong Objects, contrary to the Rules of Instinct, Reason, and Revelation, they were also to be re-united, but degraded and punished, equally to their degrees of Demerit.

Man having fail'd in pursuing his way to Heaven, by a State of Life nearly Angelick, was, through God's intervening Mercy, by new Conditions, or a new Covenant, put upon trial to work his way thither, by paying a grateful Homage in Mind and Body to his Creator, and performing social Duties. It was found now by dear Experience, that if Mankind had not bodily Employments, they would be continually doing Mischief; and what fitter or more natural Employment could God find Men, than to assist in producing, educating, instructing, and maintaining their own Species, to bring them to the end he design'd them for, to join with him to procreate and make those Creatures happy, which he had created a Race of, and done his Part to make them so. What could he do more to reasonable Creatures, than to create them, and means to sustain them, and give them Parts and Powers to go forward, and make it the terms of their Happiness, to do the rest reciprocally for one another themselves.

The Parts of the World might have been adapted to yield Food, Clothing, &c. and the Parts of the Body, &c. might have been more properly adapted to procure Necessaries with less Labour. Nay, Man might have been made Angelick, and needed none of these Things ; but being maintained without Employment, would not answer the state of his Probation, in this state of Society. If there had been too much Plenty, and too little Labour, 'tis pretty easy to guess how the case would have stood, between Parents and Children, Masters and Servants, Princes and People ; but the size, quantity, number, duration, &c. of Man, and each other sort of Creatures, and Things, were made in proportion to one another, and to the ends aforesaid ; and every Thing out of Paradise, in the whole Creation, appurtenant to this Globe, was adapted to keep them in Societies, and to keep them employed in those Duties, during the several Ages of the World. Some Things were framed to afford Things in that proportion ; and some Things to destroy and hinder Things from increasing in Plenty, beyond that proportion. Some Things were difficult to be taken, some difficult to be produced, and some difficult to be made

made useful, and some difficult to be discovered; some difficult to be won when discover'd; some to be fetch'd from distant Places; some Creatures to keep them in Societies, and some to oblige them to preserve those which are useful; some Things to employ the Heads of the Intelligent, to discover and contrive, and others the Hands of the Labourers to Work, and most things to need the Assistance of many Heads and many Hands to contrive, procure, and make them useful; and all the several Dispensations were suited, to keep up this proportion. To *Adam* and *Eve*, as it seems were only given Fruits, and Seeds for Meat, whilst in Paradise, two Fruits excepted. If it was forbidden to eat Flesh before the Flood, there was no other use to propagate the number of the Beasts, except to offer in Sacrifice, or to eat up the Grafs, &c. and keep the Earth clean, as they were all to be destroy'd, except a Pair of each at the Flood. But to prevent Man from having too great Plenty of Food, if the unclean were only forbidden, the Institution of sacrificing the clean Beasts (though the practice only, and not the Institution is mention'd) 'tis likely was to the same end. It seems as if either

Adam

Adam knew the uses of each Beast, Bird, &c. and that Knowledge was deliver'd down, or else that it was reveal'd and directed, for before the Flood, the Text distinguishes them by Clean and Unclean; and though *Moses* mentions the Sorts of Vegetables Men might eat, there was no Occasion to mention the Beasts, because it was to be done in his Law. There is no mention made of any Order of Men at first to instruct the rest but Parents, and there seem'd no Necessity in Natural Religion, because it was imprinted in every one, and every one was thereby impul's'd to perform his own Duty, in instructing, obeying, and acting; who were to offer the Sacrifices, whether any one, or only the Fathers or Heads of Families, is not clearly directed but by Practice. The general Permission to use all Flesh, Fish, &c. except Blood, from the Flood, to the *Mosaic* Laws, seem'd to be absolutely necessary, while the Earth was sterile and produc'd no great Plenty of Fruits or Herbs, till it was meliorated by the natural Agents, or cultivated by Labour, and the Trees, Plants, &c. had sprung, spread, or been planted, sown, &c. The Confusion, and thence the Necessity of acquiring the Knowledge of Languages

guages to those who would study, was likely contrived to employ Youth, whose Parents being rich, would not suffer to labour; and its being generally unpleasant to the Mind of Youth, perhaps to thake the Acquisition of Knowledge more difficult, especially to those whose Minds are not adapted for Knowledge, and perhaps also to prevent more being bred to study than are necessary, and to prevent unprofitable or unnecessary Studies to which Mankind is so prone.

Pharao a Heathen could say, that Idle-ness, or want of Employment, made the People of *Israel* ask to go to worship the Lord, which he took to be false Worship, and whenever they were idle, and well fed in the Wilderness, they fell to Idolatry or Rebellion. Those Beasts, Birds, &c. which were called unclean at the Flood, and 'tis likely were forbidden, and were as it appears expressly forbidden in the *Mosaic Law*, appear plainly to be such as most of them were intended for other uses, and to be of greater Service to Man, than they woudl be for Food, and those Sorts forbidden, which have no other use but Food, were 'tis likely forbidden, to prevent their having too great Plenty of Food in that large plentiful Country, from whence

whence they had driven the Inhabitants, and were not able to stock it; and the Institution of Sacrifices, the Ceremonies of the *Levitical Laws, &c.* besides, their religious and typical Ends, seem to be contriv'd to discipline, and keep the Jews employ'd, to prevent them from falling into the universal Custom of Idolatry, used among their Neighbours, and Idleness; and the Expence of Riches, and Beasts employ'd in Sacrifices, and the Numbers of Hands employed about sacrificing, the Number of Feasts, Holydays, &c. to prevent their Excess of Food; and afterwards the Prophets make frequent Complaints, that fulness of Bread, was the Occasion of their Idolatry, Rebellion, and other Vices.

There was a Necessity for Orders of Men, to officiate and instruct in Revealed Religion, and of a constant Succession, as much, or more than there was to promulgate it at first; because there has been a constant Succession of new People, who could not see the Execution of the Powers, by which it was establish'd or promulgated, and who were not born with any Instincts to direct themselves, or instruct their Children. And because the Knowledge in reading at first, and after of understanding

derstanding Languages and Study, was necessary to inform those Orders how to understand, believe, and act themselves, and to enable them to direct others how to believe and act. The Christian Religion, in great Mercy, is quitted of that load of Ceremonies and Expence, and adapted to the Time when the Earth should be more fully stock'd with People, when they should have more Employment in procuring Necessaries, and greater Necessity to relieve the Poor ; and is absolutely adapted to the natural Rules of Society, and was never intended to drive People into Monasteries and Nunneries, but to keep them out, and make them perform the Duties of Society, and prevent them from falling into the Vices and Errors which recluse People unavoidably do.

Exhortations in the Gospel, were to wean the Rich from an over-fondness of this World, so much in Practice among the Heathens, and to persuade them to relieve the Necessities of the Poor, afflicted, which would increase with the Changes in Government, Changes in Religion, Changes of Neighbours, and by a vast increase of People, upon a Motive of Charity, or brotherly Affection to all, in return of Christ's Redemption, and to make

make both depend upon hereafter for their Happiness.

The intricate Studies of Languages, Law, Science, and even of the Works of God, were adapted to employ the Time of those, who, by being freed from Labour by their Estates, have little other Employment, which were antiently the Work of the Chiefs of Families, who had the greatest Estates. If this Duty were well perform'd, many Persons would be better employ'd than they are, and there needed not be so great Estates dedicated to educate and maintain Persons of low Estates, without extraordinary Parts, to such Uses; nor the Sciences would not become a Trade for the Professors to extort vast Estates from the soft, nor the Persons would not disgrace the Offices, nor those who were made fit to labour, be maintain'd to no Purpose by such Settlements.

The vegetable Matter, the Origin of all Food, which was to be cultivated, and produce Necessaries immediately for some, and they for others, and sooner or later for all Creatures, lay upon the Surface, or was to be brought thither by Degrees, by natural Agents, such as Exhalations, Rains, &c. and most of the natural Manures

nures lye near it. The rough Stones commonly lye upon or near the Surface ; and those Sorts in Quarries are crack'd and in convenient Sizes ready for building Houses, Fences, &c. The better or more curious Sorts lye some deep, some difficult to be cut to proper Sizes, some far distant from the Places where they are to be used ; where there is no Stone, commonly there is Clay upon the Surface, or Timber, &c. or other Things which with near the same Degree of Labour supply their Uses. The Metals and Minerals (except Bay-Salt) in the hot Countries lye some deep, some difficult to be discover'd, some charg'd with Water, all difficult to be prepar'd, and made of proper Size, Figure, &c. and useful to employ the Heads and Hand of Men, and also to secure necessary Proportions to every Age. The Earth had the Properties or Abilities of producing, and the Seas of breeding and feeding at the first, or soon after the Deluge, as plentifully as they have now, else they would not have maintain'd Men as they have been, or shall be farther Multiplied ; and perhaps, if they had not produced in every Part, some Sorts of Trees, Plants, &c. and the Land been stock'd with Beasts, Birds, Insects, &c. and

and the Sea been stock'd with Fish, soon after the Creation or Deluge, the vegetable Matter would have corrupted for want of Circulation, and render'd the Air unwholsome, or the Earth unfruitful, when Men increas'd, and by Degrees, have stood in need of almost every Part of it and them. Indeed the Rain washes the Ground, and carries away the loose vegetable Matter, and dissolv'd Parts of Bodies into the Rivers and Seas, and perhaps brings it back again by Exhalations and Rains meliorated. But I think that would not have been sufficient, especially in great Droughts, to have kept the Air wholsome. If the Earth had needed no cultivating, and the Stones, Minerals, &c. had been laid ready upon the Surface, fit for Use in every Place, there had been less Occasion for Man's Labour, or the joint Knowledge and Labour of Men, and less Engagements to enter into Society upon that Account. And if the Climates had been moderate and uniform, there had been less Occasion for [Shelter or Defence against Heat and Cold, less Occasion for Houses, Fuel, &c. But as these Things are, the Ground cannot be cultivated, Buildings cannot be rais'd, no Minerals can be procured and made useful; nothing can be

be made convenient and fit for considerable Numbers to inhabit, nothing can be exchang'd from remote Parts, but by the joint Assistance of Numbers of Men, of different Capacities, Abilities, and Employments; some to invent, some to make Instruments, some to contrive, some to labour, &c. so that one may conclude, the Earth was made for Society; and the greatest Part of the Materials in it, can only be enjoy'd by Society, and that every Thing in it is useful to, or made useful by, Society.

The Grass, Herbs, and Trees, which were some for one Use, and some for another, were so interspers'd and mixed upon the Surface, and the Times of growing and decaying succeeded one another so at the Beginning, that those Creatures which were to feed upon Grafs, Seeds, Fruits, Roots, &c. should each find Employment in gathering their Food; that Men at first might gather Plants, Fruits, Roots, and Seeds, sufficient for their Sustenance; cut down Timber or Wood for Shelter or Houses, and that as Men should increase, they should find Employment, in inventing Instruments and Means, and labour in weeding the useless Plants, Bushes, &c.

out of the Ground they intended to improve; in cultivating the Ground, sowing the useful Seeds, planting the useful Plants and Trees, gathering the Fruit, Seeds, &c. making them fit for Use, cutting down, hewing, and carrying the Timber, building Houses, Ships, &c. The Honey is so dispers'd upon the Leaves of most Sorts of Plants, that the Bees find Employment in collecting it. The Leaves of the Trees, which are most of them out of the Reach of Cattle, and the Leaves of Shrubs and Weeds, whose Taste prevents Cattle from eating them, and seem to be Food for nothing, employ most of the Insect kind. in making their Nests, and laying their Eggs in them, in their Seasons, and though there be such a great Quantity of such Leaves, almost in every Place, the Insects are fully employed in gathering the proper Parts for each of their Food, and mostly prevented thereby from breeding and feeding upon the Grass, and Plants, and Grain, commonly made Use of by Beasts and Man. Though sometimes the Labour of Man, and Products of the Earth, are in some Parts invisibly destroy'd by the small Animals, and thereby too much Plenty prevented. If the vegetable Matter were more upon the Surface before the Flood, and

and readier to yield Fruit, or purer Fruit, with little Labour, and had continued so after the Flood, and had produced all useful Fruits, Seeds, Plants, Herbs, Trees, &c. and no Weeds, useless Shrubs, Bushes, Woods, &c. and had continued to produce them with little Labour, it would be the same as Paradise, and Men would have had more Opportunity of Idleness and Excess, and little Employment to procure them, and would have had no Engagements upon that Account to enter into Societies, nor no Opportunity of performing many of the social Duties in Society. In the hot Climates, where Man set out at first, some few Plants, and Fruits, and Roots, which were necessary, were ready, and but few Things were necessary there for a few People. Few Things will be produced now out of the Earth without that due Proportion of the joint Labour of Men in Society, every thing is difficult to be produc'd, and then to need so much manufacturing before they are fit for Use, as to afford Employment in the same Proportion. Every sort of Food, Cloathing, &c. to be produced or manufactured, requires so many Hands, or so many of several Sorts of Employments, that every thing is made to force

us into Families, and to keep us in Tribes and Societies, the several Seasons of the Year are contrived, some to corrupt what the other has produced of some things ; and that one Part may spend what another has produc'd of other things, so that there may be no Excess, or want of Employment for Man's Industry and Labour. Night is contriv'd that Man might not have too much Time to labour abroad, and might stand in need of Houses, Company, shelter from Heat and Cold, and Wet, Light, Fuel, &c. As Men have increas'd in Numbers and Knowledge, they have found out Means to make Beasts, Houses, &c. assist in tilling the Ground, and carrying the Products, &c. and invented Engines and Instruments of Wood, Iron, &c. and made Water, Wind, and Fire, assist in preparing them for Use, to shorten their Labour, and afford Necessaries for greater Numbers : And though they have invented Ships, and made the Wind serve to transport things from Place to Place, yet the Distance by Sea or Land, from Places where Things are, or are produc'd to where they are needed, are contrived that those things may not be procur'd without a due Proportion of Labour, and of joint Numbers in Society : Though

Though as Men have increas'd in Knowledge and Invention to shorten Labour, they have increas'd in extravagant Expence, so that their Labour to procure what they fancy they Want is almost as great as formerly. And as they have removed into colder Climates, where the Earth affords greater Quantities, and more substantial Food for useful Beasts, and Man thicker Habits, warmer Houses, greater Plenty of Fuel, &c. there the Winters are longer to consume the Products, and the rest are more needed. When Societies settle upon Parts of Continents, where there are great Deserts adjoining, which yielded nothing but a wild Beast, or a Bird by Chance; the Timber Trees, which were too strong for Shrubs, Plants, Grass, and Weeds, overshadowed, and over-run them, and cover'd the Country in those Deserts, are useful in many respects for Building, Shipping, Turpentine, Rosin, Pitch, Tar, &c. and pay for the Labour of cleansing the Ground; and as far as they go, all useless Woods, Weeds, &c. are destroy'd, or kept within Compass; nay, sometimes destroy'd too near; for the Furze, Heath-Broom, &c. are Weeds in some Places, where they have Plenty of Wood, Coal, &c. and are sow'd, and

found useful in others; and may be so, where they are Weeds now, when the Wood, Coal, &c. are spent there. If the most useful Sorts of Vegetables had been produced without Labour, Mankind would have liv'd wild, as they do in many of the hot Countries, where they can subsist to this Day; and the colder Countries, where nothing can be procur'd, without sowing and Labour, has been a means to force their Inhabitants more strictly into Societies, and other Reasons, of which more hereafter. And I may conclude of Vegetables, as of the Parts of the Earth, that the greatest Part of each was made for, and only to be enjoy'd by, Society, and that every one of them is useful to, or made useful by, Society.

Some Beasts were to feed upon Grass, some upon several sorts of them; some were tame and depended upon Man, and required Man's Care and Labour for managing and protecting them; some were easy to be taken; some ravenous and made to destroy and prevent the useful Creatures from increasing too fast, and growing too plentiful, and forced Man to take Care and Labour to protect a compleat Number of the tame useful Creatures from being destroy'd by them.

Some

Some were wild, fleet or cunning, and difficult to be taken, and Instruments and Labour were necessary to take them. Some other Creatures which naturally destroyed those Sorts, were made tame, or capable of being made tame, and affistant to Man in destroying the useless wild ravenous ones, in taking the useful wild ones, in protecting the tame ones. Some were tamed and made useful to Man, to affist him in cultivating the Ground, Carriage, &c. When Men set out at first, if they eat Flesh then, or however, after the Flood, they had no Flesh but what they could catch; and when they had made some tame, the Flesh of a few tame Beasts, and the Milk, Butter, and Cheese, they produc'd, was with great difficulty secur'd from the ravenous Beasts. And if there had been no other Sorts of Beasts created, but such as are tame or easy to be taken, and for the immediate Use of Man, and no others, either to eat up their Food, or to destroy Part of them, when there were few People to take and use them, and they had all multiply'd in Proportion as they do, there would soon have been such Swarms of them, that there would have needed no care in preserving the tame Sorts, and

little Labour in procuring that Sort of Food for Man ; and these Sorts which are useful and breed fast, then, and for which there is a Necessity, that they breed as fast now, would at first, in a short Time, if there had been no other Sorts to devour Part of them, have overstock'd the Earth, and starv'd one another. But as those wild Sorts which devour, hurt not one another, but only feed upon the useful Sorts, that was prevented. And though this seem Destruction and Waste, so long as Man in each Age has that due Proportion design'd, there is no more los's by one Beast, Bird, Fish, &c. eating another useful one, than by Water being spilt out of a Vessel upon the Ground ; since the vegetable or animal Parts, when eaten and converted, pass'd to the Parts of another Animal ; Part to Excrements, are not lost, but put into a new Motion, apply'd to new Uses as Water spilt is. If there had not been monstrous, ravenous, destructive Beasts, such as Lyons, &c. and terrible Creatures, such as large Serpents, and where Men set out at first, not only to destroy the Superfluity of useful Creatures, &c. but to fright People from separating, and destroy the Stragglers, as there was sufficient Means in those Climates,

Climates to live alone, while few, Men were so proud and averse to Subjection, filial or political, and so fond of Liberty and Independency, that each couple would have ran from the rest, liv'd together upon the Fruits, Beasts, &c. which those Countries afforded in Plenty, left their Parents when old, to starve and turn savage, as many are at this Day, and created infinitely more Tongues, Religions, &c. than can be imagined, and, in the main, lost all Knowledge of God, or their social Duties, all Possibility of Improvement in Science, &c. and when the Parents had died, and left young Children, they would have been starv'd, and those ravenous Creatures abound most in the hot Countries ; I think several Sorts, peculiar to each Country, where Men are most liable to be tempted to run out, and turn savage ; whether there were more placed there of each Sort, or they are suffered to increase there more by Man's Savageness, deserves Consideration. But were there not such Creatures in those Countries, where Men are almost savage, to keep them together in Tribes, or Bands, they would separate more, and be more savage. Where Societies of Men have establish'd and

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and cultivated the whole Country, savage Beasts are destroy'd, or brought within Compass. Those which destroy other Sorts, are destroy'd by the Strength or Policy of Men, by Dogs, Nets, Guns, Traps, &c. and the necessary Instincts, manner of breeding, growing, &c. in the useful Sorts remain; Where Societies are settled upon Parts of Continents, where there are great Deserts adjoining, and those cruel ravenous or destructive Beasts, which shun Societies of Men, are in those Deserts, Instincts to breed, Temptation of feeding upon Grass, Greens, &c. drive those Beasts which are unarm'd, fearful, and useful, out of those Deserts, to among Men, and give Men an opportunity of taking them; and as those Deserts are improv'd and inhabited, those ravenous Beasts are destroy'd, or remove; so that one may truly say, the most ravenous Beasts, are friends to Society, and the useful Sorts cannot be protected, enjoy'd, or taken out of Societies, and that all Beasts are useful to, or made useful by, Societies, and both find Men Employment to provide for, inclose, preserve, and manage, the useful Beasts, destroy the destroyers, take the wild and useful ones.

Some

Some Sorts of Fowls, or Birds, are easily made tame, and depend upon Man for Food and Preservation; some which are useful, are not very difficult to be taken; some devour and destroy the useful ones; some which are wild and destroy, and some which are wild, and do not destroy, are made so tame, as to assist in taking the useful wild ones; some are wild and swift, and require Instruments and Labour to destroy the useless, and take the useful; some of them feed upon useful Grain, and require the Labour of Man to destroy them; some of them feed upon, and destroy the Seeds of Weeds, and hinder them from propagating too fast; some feed upon Carrion; some upon Insects at Land; some upon Insects and small Fish in the Waters, and some amphibiaously, both at Land and in the Water. When Men set out at first, 'tis likely very few Fowls came to their Share, they had neither skill nor means to take them; and when at first, they took and kept some of the Sorts which may be tamed, they were a Prey both to the voracious Birds, and to several of the voracious Beasts, and very difficult to be protected and preserved; and as I said of Beasts, if none but useful and

no

no Destroyers had been created, they would have bred so as to have eaten up every Thing, Fruits, Grain, &c. and Man with Bow and Arrow, or such Inventions as they had for a long Time after, could never have kept them under, but they would have eaten up every thing, and in the End have starved one another ; but that has been prevented by the Destroyers, not only at first, but in the uninhabited Countries ever since. If there had been no Destroyers, and the useful ones been tame, or not swift, but *easy* to have been taken, mankind would have had no Employment upon that Account, but would have been tempted to have run out, and liv'd savage as aforesaid ; but as they are difficult to be taken ; Men at first had, and even the savage wild People have ever since had, sufficient Employment in taking them, even with the Helps of Societies, Inventions of Guns, &c. Where Societies of Men have establish'd and inhabited whole Countries, the voracious, and those which destroy the Fruits, Grain, &c. are destroy'd or brought under by Hawks, Dogs, Nets, Guns, Engines, Decoys, &c. and the tame Sorts are preserv'd with less difficulty ; but

but both the tame are protected and preserv'd, and the wild taken with such a due Proportion of Care and Labour, as answers the Pains taken about other Products of like Value. Where Societies are settled upon Parts of Continents, where there are great Deserts adjoining ; the voracious Fowls, drive the unarmed, fearful, and useful, out of these Deserts, to among Men, and give them an opportunity of taking them. And as those Deserts are inhabited, the voracious and useleſs Sorts are destroy'd or remov'd : As their Wings make the useful Sorts difficult to be taken, yet they give those Sorts, an opportunity to come in our way to be taken, which without Wings, could not ; for Instincts to preserve their young, from Creatures in Deserts, and desert Countries, drive many Sorts of Fowls annually into inhabited Countries to breed ; other Instincts make other Sorts shift, from one Climate to another, to Places where proper Food, Seeds, Grains, Insects, &c. will be ready, and make the desert Countries, and Deserts, pay their Tribute to Societies. Tempestuous Weather makes the mountain Fowl, which feed upon Crops, Buds, Berries, and perhaps some of them upon the Insects there, come down into the inhabited Vallies, and yield a Tribute
from,

from the wild Mountains. Instinct to breed in proper Places, drives many sort of Sea Fowl to Land ; and tempestuous Weather, or, &c. drives great Quantities of Sea Fowl, which feed upon the Sea, into the fresh Rivers, Meers, Ponds, &c. and give Men an opportunity of taking them, and reaping that Fruit of the Sea ; and what is most remarkable, each Sort give an opportunity to take them in that Season, when they are in the best Condition, fattest, and fittest for Food, for Men. What Government, or Direction, the several Sorts of Birds, which shift from Climate to Climate, have among them ; whether they can trace one another by Smell in the Air, or how they collect into Flights, and go the same Course, I know not ; some Birds, and Beasts, which are Rarities, are difficult to be taken ; and some which destroy Birds, &c. and some of small Value, which are not Destroyers, are so cunning, or fleet, or swift, that they cannot be taken without great Charge and Pains, by hunting, fowling, &c. seem to be made to employ those Men who live in Society, and scorn to do any real good in Labour or Study, and keep them out of greater mischief. So I may conclude, that

that the tame Sorts cannot be preserv'd but in Society ; the wild cannot be taken, nor the Destroyers destroy'd, without great difficulty, but by Societies, or by Instruments, which are the Inventions and Labour of People in Societies, and which the savage People could not have, but from Societies ; and keeping those Things from them, would be the most likely Means to bring them into Society, and would be of greater Advantage to the Race of Man, than the Skins or Furs of a few ravenous or wild Beasts, which they give us in Exchange. And that the ravenous as well as the useful Fowls, have the one been useful to, and the other made useful by, Societies ; the Uses of those which feed upon Insects at Land, and many of the Sea Fowl, will appear more properly under the Heads of Insects and Fish ; and as those two Heads have not been explained in general, but only in Particulars, I must beg leave to be a little more prolix.

As there was to be a continual Circulation of Things, and each of the Vegetables was to cast forth Effluvia and Excrements, such as is sensible in Heath, &c. and perhaps, that which disorders People in a Wind, which passes over a Continent,

tinent, not fit for their Nourishment or Growth, or the Composition of their Parts; as some of the Vegetables were to be eaten by Animals, and those Animals were to cast forth Effluvia, and leave Excrements, and some of these Animals were to perish, and the Parts corrupt; and as some of those Vegetables were yearly, some at longer Periods to grow and decrease; and those Parts which were not eaten, were to corrupt, and as some corrupted Parts were to afford Matter to supply the Production of others; it was necessary, that those Parts which are not apply'd to those Uses, and which would fly about in the Air, and corrupt the Air, and render it not fit to breathe in, should be gather'd up by some small Agents, such as Flies and Insects of different Sizes, either from the Bodies, or flying in the Air; some to gather that which should be useful for Men, such as Honey, Silk, &c. and others to gather those Effluvia, Excrements, and those corrupted Parts for Food; and as those small Agents were not fit for the Food of Men, it was necessary that other Creatures, such as Birds, Fish, &c. should be prepared to gather them, and so on; some upon the Earth, some in the Air, and some in the

the Water, and some as Snakes, &c. in the Walls, Holes in the Earth, &c. where those other Creatures could not come ; and that the Birds, Frogs, &c. which collect those Insects in the Air, on the Land, &c. and are not to be taken, or not Food for Man, should afterwards go into, or fall into the Water, and become Food for the Fish ; and as the Rains, Floods, Tides, &c. were to wash the Soil and vegetable Matter into the Rivulets, they into the Rivers, and they into the Ocean ; and as the Fish were to cast forth Slime, Effluvia, and Excrements, and some of them to die and corrupt in the Sea, or upon the Shore ; it was necessary there should be infinite Numbers of small Animals, Insects, or small Fish in the Rivers and Ocean, perhaps some of them to breed in, and their Young to feed on the Leaves of Vegetables there ; some to lay their Spawn, and breed upon the corrupted Parts of Fish, and some to gather up the vegetable Matter, Soil, Effluvia, and Excrements ; others to gather up them at Sea, and Fowls, &c. to gather up Corruption on the Shores. And as all Sorts of Animals were liable to Diseases, and to cast forth unwholesome Effluvia, or to be wounded, or have

Sores, &c. and those Wounds or Sores to cast out corrupt Humours; and as the Excrements of some Creatures would stick upon their Coats, such as Sheep, &c. it was necessary that several Sorts of Lice and Flies, should lay their Eggs, where there happened to be corrupt Effluvia, Humours, or Excrements, to gather up the Matter that perspires out of the Skin, runs out of the Wounds, sticks upon the Coats of Men, Beasts, Birds, Fishes, &c. and might be infectious; and the Insects, by Instinct, some chuse to lay their Eggs, and make Repositories for their Young in the Leaves of one Sort of Trees, Plants, &c. some in those of others, to eat up the Effluvia, or Excrements of them; others chuse different Sorts of corrupting Matter, lay their Eggs in, and feed upon, the Sort they like; and as they cannot breed, nor live, but where the Food they chuse is, they have each Means to convey themselves to Places where it is, so that nothing may corrupt without being eaten up, by Land, Water, &c. That the Earth, Air, Water, &c. might be freed from Corruption; and that that Corruption, after passing many Dissolutions in several Stomachs, Separation by Strainers, &c. should at last terminate in Food for Creatures fit for the Food of Man, and furnish Necessaries for

for Food, not much inferior, and in considerable Proportion to what the Plants themselves afford.

As Things stood, there seemed to be a Necessity at the Creation for the Earth to produce Insects of all Sorts and Sizes upon every Part of the Surface, each proper for the Parts where they were produced, and of Sizes proper to gather the several Sorts of useless or corrupted Matter; and that the Waters and Sea should produce other Sorts to like Purposes: And that they should breed in great Numbers, and speedily, in Proportion as the several Sorts of Corruption, each Sort choose for Food increased; nay, as soon as any corporal thing was ready to corrupt, or be obnoxious, and the then present Numbers were not sufficient to devour it, that they might lay their Eggs for young ones to breed immediately, to devour the Carrion, or any great Quantity of corrupt Matter, offensive Effluvia, &c. and that the Maggots, or the first Figures, the several Sorts of Young appear in, should suddenly have Wings to fly, Instruments to swim, run, or, &c. that when they have eaten up the Corruption, they should not die and corrupt themselves, but shift to seek other proper Food: And that those Insects bred

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at Land, after their Service, might not be obnoxious either by Numbers, or corrupting, it was necessary that there should be Birds in the Air, Fishes in the Rivers, Sea, &c. to catch them, or receive them, as they come near the Surface of the Water, fall into it, or are washed into the Waters: And that at the End of the hot Seasons, when there is no further Occasion for them, when the Heat is abated, which dissolves and raises putrid Matter, the remaining Flies, &c. should be removed without Offence; that many Sorts of them should change States, and be reposit'd, some as Cod-baits, &c. for Food for the Fish in Winter, and Ants, &c. wrapt up in Cases for Food for Pheasants and other Birds; and others for Food for other Creatures; and that those that escape should preserve themselves alive, one would think, without Food to breed next Year: And that those which had finished their Progress, escaped being eaten, and died, should be washed into the Water, and eaten up there: And perhaps those Insects, which feed upon, and are composed mostly of volatile Salts, Spirits, and other volatile Parts, are most proper Food for the Fish which live in that grosser Element of Water. And as those Insects, which

which are Food for the Fish, could not, as their Busines was to collect the Corruption in every Place, be confined to Places where Water would wash them, all which escaped being taken by the Fish, into the Rivers, &c. nor by the Tides, which daily wash them out of the low marshy Grounds near the Rivers, &c. where it flows, and fetches them into the Sea, so there was a Necessity that there should be Agents at Land, and in the Air, such as Birds, Snakes, &c. to devour them where they were not serviceable, were in too great Numbers, had done their Work, or might be obnoxious, especially in great Droughts, when the Ground is not washed, and their corrupting might occasion Distempers. Tho' we have not Opportunity to make Observations what the Insects, Natives of the Waters do, doubtless their Uses are to the same End, the Difference in the two Elements considered: And from thence it will follow, there was a Necessity for such Birds at Land, and Fishes in the Water, quite over the Surface of the Earth: And as there were infinite Numbers of Fishes, and Birds necessary to collect, these Collectors of Corruption, more than ever could be taken or used by Man, and many Sorts not fit for

Use, it was necessary that they, more especially the Fish, should breed vast Numbers, besides other Reasons, which will be mentioned hereafter. And that there should be yet other Sorts to devour them, there seemed but to be Occasion for a few of those Beasts and Birds which were preserved in the Ark ; nor that they should breed very fast ; but there seemed a Necessity that those Sorts of Creatures which were to free the Earth, Air, and Seas, from Corruption, should be preserved in or upon the Waters at the Flood in greater Numbers : And that they should breed great Numbers in a short Space all over the Earth and Seas after the Flood : And though perhaps every living Creature out of the Ark was destroyed, yet the Spawn of the several Sorts of Fish, and the Eggs, or Deposits of the several Insects, might be preserved in one Climate or other; perhaps Swallows, &c. which remove over the Seas from one Climate to another, gather Flies, and breed here in Summer, in passing over the Seas, most of them fall a Prey to the Fish, and perhaps many Sort of the Water Fowls, which clear the Shoars of Corruption, and are rank, and not pursued by Man, fall a Prey to Sea Fish, otherwise they would increase infinitely.

nitely. Those other Fowls, which frequent the Sides of fresh Rivers, &c. gather up Worms, and gather or fright the Frogs, &c. into the Water for Shelter, as they think, but indeed into the Mouths of the Fish, are some of them useful to Man, and the rest serviceable; nay, even some of those Sorts of Fowls, which gather up the Insects which feed on Flies, which feed on Corruption, are not Meat for Man; and those which are not, but are destroyed by the larger, which are not Meat for Man, are likewise thereby serviceable: And those Creatures which are designed for the Uses aforesaid, and not to be taken for Use, or Food for Man. The Insects at Land, or Water, by reason of their Minuteness, Swiftness, quick Sight, quick Motion, Shelters, or, &c. The Swallows, and other Birds, intended for the same Use, because of their Swiftness, Places of feeding in the Air, or in the Waters, are scarce to be taken or diminished considerably by Man, with the Assistance of all his Inventions, or that of other Creatures.

At first starting of Men, or after the Flood, in the hot Countries, nothing could be preserved without Houses, Bay, or other Salt, &c. If a Man took wild

Beasts, Birds, or Fishes, they were only Provisions for that Day, the Flies would lay their Eggs upon them, corrupt them in a Day, and eat them in one or two more. In Societies Men preserve Beasts and Birds tame, take them when they want, divide them among Numbers of People, or preserve them in Houses, with Salt, &c. Few Fruits, Roots, or Seeds, which grow naturally, without planting, or sowing, will keep; and those which will keep, could not be kept without Barns, Granaries, &c. but Rats, Mice, Frogs, Moles, and many other Sorts of Creatures, would eat them, or carry them off; and those Sorts, which have Moisture enough in them for the Elements to work upon, by endeavouring to make them sprout and grow, renders them not fit for Use; and those Sorts which have not Moisture enough in them, but are seemingly dry, when housed, will, without great Care be taken, mould, or Worms will breed in them, and eat up the Kernels, and none of their Juice can be preserved without Cellars, Vessels, &c. The natural Salts, &c. in the Air, Water, &c. canker or dissolve the Works of Man, in Metal, Stone, Timber, &c. which are not worn, or used. The Moths and Worms destroy the Timber of Houses, Ships,

Ships, &c. the Stores of Grain, &c. kept too long; the Garments, Household-Goods, &c. not employed, or worn; so that all these invisible, or small Agents, labour to distress Men out of Society, and force them in, and to prevent their hoarding of Things in Societies, and having too great Store; and in an Age or two, to destroy the Things most useful and necessary, and the smaller Things in less Time, to find Employment upon that Account, for all Men, in all Ages. Whether the Winds, which we call Blights, bring the Flies, and they poison the Leaves, by making Nests for their Young, or those Winds bring Effluvia with them, or wither and corrupt the Leaves, and so bring or make Food for those Insects, and give them an Opportunity to breed and eat it up, whether the Worms in the Stomach, Guts, &c. of some Creatures, or the Lice in the outward Parts, may cure any Disease in the Creatures, or they are intended to impoverish or destroy some of that Species, or to employ Man's Care and Industry to destroy them, or, &c. whether those Maggots, which breed upon the Filth or Sores of some live useful Animals are to keep them clean, or employ Man's Care and Industry to keep them clean and sound, or destroy

destroy some of the Species, and prevent their breeding too fast; or to every one of these Uses, they answer their Ends. They not only keep the Earth, Air, and Water, wholesome, support the Fish, of which next in Course, make it difficult for People to live out of Society; but sometimes restrain the Excess of Fruits, waste and consume things, which would otherwise endure too long, and thereby keep Men in Societies employed in that Proportion, which is necessary for them in their Stations, are conducive to, and made for the Good of, Societies.

As there are such infinite Numbers of Insects in the Air visible, which breed such infinite Numbers yearly, and such infinite Numbers of Earth-worms, and other Insects in the Earth, almost invisible, and which breed such infinite Numbers yearly, that perhaps, if gathered, the Quantity in each Acre of rich, dry Grass Ground, would fill a Bushel, and such vast Numbers of larger Creatures, such as Frogs, Birds, &c. necessary to gather up the offensive and useless Matter at Land, it was necessary there should be a Subordination of vast Numbers of Sorts of Fish in the Waters, some to gather up these, others to gather up them, &c. each of Figures

Figures and Sizes adapted to their Manner of breeding, feeding, and to answer their several Ends: And though God has not made Fish Members for Copulation, wherewith they might engender and breed Young, or made the Spawn or Eggs of the female Breed, without further Assistance from the Male, nor has made the Females assist in breeding or hatching their young Ones, nor given them Breasts, or other Means to feed their Young, or to defend their Eggs or Young from Injury, yet he has ordered the Spawn in each Sort of them, to be ready to be cast at such Seasons, when they go to and from proper Places, and given each Sex and Sorts of them Instincts, or Knowledge, to answer all those Ends by other Means; for the Males attend the Females when they go to spawn, and if the Males be not present when the Females are ready, the Females will fetch them to cast their Milt upon the Spawn, or Eggs of the Females, which produces Generation, and to cast their Spawn in such Places where it will come to Life, and where there will be proper Food for their Young as soon as they are bred; and has made such Sorts of Insects, &c. as are proper Food for their Young by several such like Instincts,
to

to be ready for them at such Seasons, and in such Places; and to the most useful Sorts of Fish to breed in such Places where those other Sorts, which would destroy them whilst so young, cannot come, and at such Time as there is Opportunity for the young ones to go down to the Places proper for their Growth: And notwithstanding the different Seasons in which different Sorts cast their Spawn, and the different Places each Sort cast it in, all Sorts of Spawn comes to Life here, I think in Spring or Autumn, at the Seasons their several Sorts of Food will be ready, some sooner and some later; and since some Sorts of Spawn lie six Months, and some but one, it is certain there was some other Ends to be answer'd besides hatching the Spawn.

It is likely Salmon-Trout, and those Sorts of Fish which spawn in the Beginning of Winter, press up as near the Heads of the Streams as they can go, because the nearer they come to the Heads of the small Streams, or Springs, the less liable the Spawn they cast, and cover or bury, is to be removed by Floods, or oppress'd with the Weight of too deep Water, or to be deprived of the Influence of the Sun, by the Depth of the Water, and less

less liable in Spring-water, or running Streams, to be prejudiced by Frost, and where the Gravel or Sand is so small, and so little pressed with Water, that they can dig Trenches to cover their Spawn, and that the young Fry, when they breed, can get out; and that is not only the most proper Season, when the Water is at the highest, for them to choose the most proper Places where it will not increase to prejudice their Spawn: But when there is most Water, they can get up to the Places whither they could not go up in Winter for Ice, nor in Summer for Want of Water; nor return, if they went up in the Spring, and staid casting their Spawn till the Water abated; and in those small Streams, their Fry not only meet with Flies and Insects, the most proper Food for them in their Return, but are preserved from such large Fish as would devour them, if they were among them before they got Strength or Speed to escape them.

Pikes, &c. whose Young feed upon the Spawn and Young of Insects, Frogs, or other small Reptiles, or Fish, have their Seasons of spawning in the Beginning of the Spring, about *March*, suited to the Season proper for the old ones to get up into the Ditches, Carrs, or Pools, the Places proper for casting their Spawn,

Spawn, whither they could not get up in Winter, because such Places freeze, and where their Spawn would be destroyed by Frost, if cast before, or in Winter, and whither they could not go later in the Spring, because few Floods happen after that Season, nor Rains sufficient to swell the Rivers, so as the Waters may go up the Ditches into them, nor continue there Time sufficient, and in Quantity sufficient to bring the old ones down the Ditches into the Rivers, nor for their Spawn to breed and return into the Rivers; and the Times of the breeding of the young ones are also suited to the Time, when the Spawn first, and afterwards the young ones of the Frogs, Insects, small and useless Fish, will be ready there to feed them, and where no Fish of Prey can come to destroy them: And Perches, &c. . . . when young, feed upon the Spawn, or Young of the small useless Fry, cast their Spawn in *March*, or the Beginning of *April*, upon the Shoals, Stones, or Roots in Rivers; and their Spawn quicken in *May* or *June*, at the Time when the small Fry cast their Spawn, and breed there; and Roach and Dace spawn much about that Time, and mostly in the same Places and Manner: And the Gudgeons, Minnows, &c. whose

whose Spawn is very small, is cast in the warmest Weather, and soon brought to Life, and their Young have the Eggs and Young of smaller Insects provided for them in that Season.

Those Sorts of Fish, which live in stiffer and fouler Water, and are so inactive, that neither the old ones could get up to the Tops of the Rivulets, nor into the Carrs or Pools, such as Chevins, Bream, Carp, Tench, &c. which only feed upon Maggots, Worms, Flies, and Insects, or the Juices in the Waters, cast their Spawn in *May*, when Flies, and most Sorts of Insects breed to feed their Young, and go not far to cast it, only into the neighouring Shoals or Edges of the Rivers, or among the Roots, or Bushes in the Banks, are not able, do not attempt, nor need not cover it, because the Frosts, or Floods do not happen to destroy it then, and because it will soon come to Life; and the young ones feed on the Shoals and Edges, and some take Shelter under Stones, and some among Weeds, Roots, &c. on the Edges of the Rivers, to preserve themselves from great Fish of Prey, which would destroy them; and by this Means also, each Sort of Fish are kept to their proper Places; for as the Spawn of Stream-Fish will, if cast

cast in still, shallow Water, be destroyed by the Frost : On the other hand, if the Spawn of Carp, or these Sorts which cast in *May*, and in very shallow Water, be cast in Rivers, which have too great a Descent, it is left dry by the sinking of the Water, or is hindered by too great a Feed of Water, or some other Cause, and they seldom grow numerous there, so seem to be designed for standing Water, or for Climates where the Waters keep up in that Season.

Chars, and some other Sorts of Fish, which are peculiar to great Lakes, which are fed immediately by Springs, and therefore do not freeze, cast their Spawn in the Beginning of Winter, upon the Shoals and Edges of the Lakes, it is likely for the same Reason, as Salmon and Trout cast theirs, in such Places at the same Seasons ; and the several Sorts of Fish which are common to Rivers and Lakes, go out of the Deeps in the Lakes to the Shoals, or neighbouring Streams, Ditches, Carrs, &c. as the same Sorts do out of the Deeps in Rivers.

The most useful sort of Sea-Fish, such as Salmons, which I have mentioned, come out of the great Deeps, in Spring, into the Rivers, feed upon Insects, &c. there

there in Summer, and in Autumn post up to the tops of the Rivers. And Mullets,— and several other sorts of Sea-Fish, come up into those Rivers, as far as the Tides flow, to the same Intent; and Herrings come every Spring and Autumn, out of the great Deepes, in the Northern Seas, into these Climates, where the Sun has more Influence; and unto the Coasts of these Islands, where there are hard bottoms proper for them to fix their Spawn upon; and never go to the West side of the Channel, where the Coasts are sandy, and their Spawn, if cast upon them, would wash away; chuse their places, so that it may come to Life; and where their young may meet with proper Food, till they are able to go to the North, the proper places for feeding and growing them; and when they have shot, and are weak, retire into the Bays and still Water, on the Coast, till they are recover'd. And the Pilchards, Mackerels, and other Sorts of Fish, come likewise out of the great Deepes, perhaps from Places far distant, into the Shoals, in these Coasts. Cod, and larger Fish, to the Banks, each at certain Depths to the same Intent. And if due Observation were made, of the infinite Numbers of other Sorts, I doubt not, but

the Season when each Sort spawns, in each Climate, is adapted to answer all Conveniences, both for the going and returning of the old ones, and the breeding and feeding of the Young; and that the young of Insects, and the useless Fry, proper for the Food of each Sort of the useful young ones, are ready at the Time and Place, where those young ones breed. And as some Creatures spend much of their time, annually, in breeding and feeding their Young, these Fish spend as much Time and Pains, in going to, and returning from, Places, where their Young will be bred and fed. What Government or Direction the several Sorts of Fishes have; whether those in the Sea can trace one another by Smell, or how they collect into Shoals, and go the same Courses, I know not. But by these Instincts, and their being accommodated to proper Seasons, and other Things being accommodated to the same Seasons, Fish multiply, grow, and feed infinitely faster, than any other useful Creatures, which breed or hatch their Young, and feed and defend them while they are young. And as Fish were intended to be taken when they came to spawn, it was necessary that the Numbers each should breed, should be so great, that perhaps

perhaps if a Million came to spawn, and a thousand scaped and bred, and the rest were killed by other Fish, or taken by Man, the breed and number might be upheld. The Bodies of Whales, and some of the useful Sorts of the greatest Fish, which are too strong for Hook, Net, or any Instrument, Man has yet invented to take them within the Water, are so contriv'd, that they cannot stay many Minutes under Water; and that when they sleep, rest, or are kill'd, a considerable part of each lies above Water, and thereby gives opportunity to a few Men, single hand, to kill and take those monstrous Creatures, which if they'd continue under Water, the united force of a Thousand Men could not do.

Though all this regular Scheme seems to be contriv'd for the propagation and benefit of the Fish, their Creator and the Author of these Instincts could have adapted their Spawn, to have bred in any Climate, and in the greatest Deeps, and made Food for their Young attend them there, as well as he has made the Food for the old ones attend them there, and given the Young shelter, or means for Protection there. But his providential Goodness has, by these Instincts, render'd all, even the

most inaccessible Deeps, and even those in the most uninhabitable frozen Parts of the World, almost as advantageous to Man, as the dry habitable Lands. For these, or some such Instincts, or Motives, make those Sorts of Fish, which live in rapid Rivers, or great Streams; run up into the small Rivulets and back to their Heads; and give those who live all along, an opportunity of taking them in that Season. And others which live in deep still Rivers, and are difficult to be taken, these run out into the neighbouring Shoals; others into the Ditches, Lakes, Pools, &c. and give People who live upon their sides, an opportunity of taking them; and some of those Sorts which live in great Deeps; of Meers or Lakes, come out into the Shoals of those Meers, or Lakes, and others into the Ditches, Carrs, &c. and give the neighbouring People an opportunity of taking them; and most Sorts of useful Sea-fish, which live in the great Deeps, nay, even in the great Deeps of uninhabitable Climates, and could not possibly be taken, travel out, some to the Shoals, or the Shoars of our Islands, and give those who live upon the Sea Coasts, an opportunity of taking them, and make some other Sorts follow them, and the small Fry on the Coast to prey

prey upon them, and so become a Prey to Man. And other Sorts to spawn, or seek Food upon the Banks, or Shoals, at Sea, and give Fishermen an opportunity of finding and taking them there. And other Sorts to journey out of the Deeps into the Rivers, as far as the Tides flow, and give those on the fides an opportunity of taking them ; and other Sorts to post out of the great Deeps, up the Rivers to their Heads, to the greatest distances from the Sea, and give all those who live along their fides, an opportunity of taking them ; so that each Sort are to be taken when they are in their greatest perfection ; and the different Seasons of the greatest part of their coming to spawn, &c. furnishes one Sort or another during the Spring ; and that part of Summer before the Beasts are fed, or the Fruits of the Earth, Grain, &c. are reaped ; and after the Fowls, which are mostly in season in Winter, are out, and those cured by Salt for all the Year ; and other natural Instincts or Motives, make each Sort of the old ones, which are not taken, as soon as they have cast their Spawn ; and the young ones, as soon as they are able, make the best of their way down to the great Rivers, Lakes, or Deeps in the main Ocean ; nay, some Sorts, not

only of the old ones, but even their young, without any Guides to the Deeps in the most distant, uninhabitable Climates, each Sort to the places which afford that Sort the most proper Food, &c. for growing or feeding, till the Season of spawning returns; and they make their returns fat and full of Spawn, to the intents and places aforesaid; and each sort of them in their proper places, and in the proper Seasons feed upon, and destroy, those Flies, Insects, and Creatures, which are bred on useless Leaves, feed on the Putrefaction of Vegetables, or Animals, by Land or Water, which would be otherwise nauseous, or noxious to Man; and perhaps some Sorts of them suck the Juices of putrefied Matter out of the Waters, and prevent their further Putrefaction. There some feed upon Weeds, in the Waters, nay, some upon the vegetable Matter wash'd out of the Earth into the Water; and thereby all those sorts which seem useless, all the smaller Fry, and all the Insects, even to the smallest, nay, even those Things which seem superfluous, needless, nauseous, or noxious, feed those noble Foods of Fish, and Fowls; so that we eat up every thing, even Corruption,

or

or useless Things, when they are brought to the utmost Perfection.

Crabs, Lobsters, Oysters, Cockles, Muscles, and such Sorts of useful Shell-fish, some which cannot move any considerable distance, and some which cannot move at all, cannot be obedient to any such Instincts, nor preserve themselves by Flight, have (though little observ'd by us) such Instincts as propagate their Species, and are arm'd with Shells, &c. to prevent their Destruction by Fish of Prey, and have Food provided for them upon the Shoals, and in the Coast where they live and breed; and are ready, some upon the Shoars, some at greater Depths, for the Use of Man. How some of these Sorts extend their Shells with their Bodies; how some of them cast their Shells yearly, and grow in size before another Shell be form'd, what means those Sorts use to protect themselves, whilst they are naked, deserves Enquiry.

Besides those useful Sorts of Fish, which are Food for Man, there are infinite numbers of Sorts of different Shapes and Sizes, which at first view seem, some of them, to be useless, and many of them Enemies to Man, because they prey upon, and destroy the useful Sorts, nay, Men themselves, if they can come at them; among

F 4. which,

which, I may place the amphibious Animals, which inhabit always in or near the Waters. But if due observation be made, it will be found there is a necessity for every Sort of them, and for a due number of every Sort ; for as all Fish prey in proportion to their Sizes, if the small that prey upon Insects, were not prey'd upon by larger, and they still by larger, up to the largest, and the greatest were not made to breed slowly, or, &c. as Men, even in Societies, cannot proportion the numbers of Fish in the Rivers or Sea, to their Food or Use, or cannot increase their Food by Labour and Care, as they can of Beasts and Birds ; any Sort not prey'd upon, would exceed the proportion of their Food, overcome and destroy the Species which should feed them, put the whole Scheme out of order ; in the end want Food themselves, suffer that Species which those they feed upon, devour'd, and kept in proportion, to increase and eat up all the Sort they used to feed upon, till at last, those Insects which gather up the Corruption, would be destroy'd too near, and the Corruption become noxious. If those which destroy the Insects, were destroy'd too near, the Insects themselves would be troublesome, and perhaps noxious ;

noxious ; and the same Disorder would happen if any Sort or Size were wanting, among the other Sorts, upward to the highest ; and besides, keeping this proportion, several Sorts of Fish may have other ends, perhaps some of the ravenous Fish in the great Ocean, drive some useful Sorts to the Coast, and give Men an opportunity of taking them ; and others which seem useless to us, either drive those which are useful to pursue their Instincts, and remove to Places where they may be taken, or feed upon Animals, which are out of the Places where the useful Sorts are, and drive those Animals to Places where they may be ready for Food, for those which are useful ; and those Parts, Abilities, and Instincts, which each sort has to pursue those below them, and escape those above them, to propagate, &c. not only keep them in the proportion above-said, but find them all constant Employment ; and find Man Employment in taking them proportionable, Value for Value, to the Employment he has in producing, and reaping the Fruits of the Earth, preserving or taking Beasts, Birds, &c.

When Men sat out at first, few Fish came to their Share, none except a few Shell-Fish which lay upon the Shores ; nay,

nay, when they came to understand Angling, only a few small Fish in the Rivers, or on the Sea Coasts, and those in continual Jeopardy from the large voracious Fish, amphibious Animals, &c. most Sorts of Fish were not to be taken out of the Sea, &c. without that due Proportion of the joint Labour of Men in Societies, in inventing and making Engines, Instruments, &c. Indeed if there had been no monstrous Fish, nor amphibious Monsters, savage Men, as they have improved in the Arts of darting, &c. would have fish'd safely on the Coasts, or in the Waters, and by their great Agility, have taken considerable Numbers. But the amphibious Animals, such as Crocodiles, Alligators, &c. upon the Coasts, and they and monstrous Fish in the Waters, in a great Measure, keep single Men from coming upon the Coasts, or into the Waters, and from getting their Food there. And as I said of Beasts, those amphibious Creatures, and ravenous Sea Fish, abound most in the Seas and Rivers in the hot Countries, where Men are most liable to be tempted, and run out and turn savage. And though Beasts at Land can only breed on the Continent or Island where they were left, or whither they are remov'd ; yet

yet as these Creatures can shift by Water whither they please, there seems to be some Instinct, which keeps the peculiar Sorts in the particular Countries where they are found. As Men have increas'd in Numbers, and enter'd into Societies, they have found out means, such as Ships, Hooks, Darts, Nets, &c, to shorten their Labour, and afford Necessaries for greater Numbers. And as they have remov'd into colder Climates, the Seas afford greater quantities of Fish, &c. and those Societies by Invention, can destroy or drive away those amphibious Animals which are too strong for single Men, or those which are unarm'd; and the most monstrous Fish are so far from being able to annoy them in Ships, &c. that they cannot possibly protect themselves, or escape their Strength or Art; so that these Destroyers, for the sake of Oyl, Bones, or some useful Parts in them, are destroy'd by Men; so that I may say, a greater Proportion of Fish, than of any other Sort of Product, was made for, and only to be enjoy'd in, Society, and that even every Sort, even the Destroyers, are useful to, or made useful by, Society.

So Men out of Society must take what the Earth produces of itself, what they can

can catch at Land or Sea, shift from Place to Place to seek Food or starve, and are forc'd to fight with all the Elements, with all the Beasts, Birds, and Fishes of Prey, for what they get, and often fall a Prey to them. Men in Society can meliorate the Earth, and make it produce Food for Cattle, Fowl, &c. to a very great Number, and produce Grain, Fruit, Roots, and many other Sorts of Food for themselves; almost for an infinite Number, and take infinite Quantities of Fish out of the Sea, and such Food from other parts in Scarcities or Famines. So that one may conclude, the Earth is fitted to produce by Labour and Improvement, Meat, &c. for the Labourers, and to spare for the Governors, Instructors, &c.

Since all inanimate Bodies, Fluids, &c. are adapted and act by the Laws of the Creator, without Instinct or Knowledge; and all other Animals act by Instinct without erring, for the Benefit of Men in Society; and since the greatest Inducement to a reasonable Creature to obey, is Conviction, that those things which are commanded are not the arbitrary Commands of a Superior, but Advice for his own good; and since the best Praise that Man can offer to God, is to explain his Goodness

ness to Man ; I shall endeavour to shew that all his Instincts, from whence his Inclinations or Passions arise, were adapted for his good ; and that his Reason, or Knowledge, or Power of comparing and weighing Ideas of things, was added to assist and limit those Instincts, that none of them should exceed their Bounds, or interfere with one another. That the Instincts in Man were sufficient to enforce him to do his Duty, and pursue his own Good, that the two chief Commandments to God and our Parents, were enforc'd by Instinct, and that the negative Commandments, were only to prevent Men from pursuing any one of their Instincts, to infringe or hinder other Instincts from being pursu'd, or to hinder them from breaking through the Order of Things design'd for their Good, whereby those Affections become inordinate. And that God has required nothing of Man but Gratitude, and to prosecute things in the best Order he could contrive them for their own Good ; and if when he created this Globe, he chiefly design'd to have Men propagated, instructed, and assisted by one another, and has fitted them with Parts and Inclinations for that End, he is no hard Task-master ; and since Man could

could not manage Knowledge conferr'd without Experience, nor could not employ himself in Worship and Contemplation, without performing social Duties ; and since if he wanted not as many things as he does, and had not as much labour as he has to obtain them, there would be no social Duties, nor he would not be kept in Society, he has no reason to complain of the Situation of things, but great reason to be thankful.

Gratitude either immediately to God or to one another, or necessity from the Nature and Order he has placed Persons and Things in, are the Causes of Love, and Reason for all other Duties.

The Duties of Self-preservation, and those to Parents, Princes, Relations, Justice and Kindness to one another, arise not from God's Commands, or the Declaration of his Will as absolute Lord, or from the Laws made by Princes, much less by People and Commonwealths, but are consequences of God's making Men sociable Creatures, and whilst God continues Men in that State, are in the Nature of things immutable.

Our natural Instincts, and the Nature of Things, with a small share of Reason if observ'd and pursued, would drive us to

to the Performance of our Duties, or make us pursue our own Good; and we can never err in prosecuting any one of our Instincts, if we did not prosecute that so far, or to break through, or act contrary to another of them, and those Instincts will answer the Test of true Reason; but depend not upon Reason, because often where Reason is weakest they are strongest: Reason should only prevent any one of them from breaking in one upon another, and take care that every one of them have it's due share of our Time, Labour, Application, &c. according to the different Times of Man's Life, the difference in Stations, or different Necessities from Accidents, from Circumstances of the Times, &c.

People say, Self-Preservation was the first Instinct; as all Instincts were imprinted together, except what alterations were made after the Fall, I suppose they mean the first Instinct that acted, perhaps it acted not before Gratitude in *Adam* and *Eve*, who had Reason at first starting: Because it must follow from want of Food or Danger, 'tis doubtless so in Infants, because they cannot exercise any other Instinct at first, till their Strength and Reason grow. This Instinct is common to all

all other Creatures, and Man, grows up with them, is very strong, and seldom too weak or defac'd in any Creature but Man ; yet there are some other Instincts stronger, for though all Creatures, except the large voracious Sort, which by that Instinct prey upon Man, shun and give way to Man, except their Property, their Life when they cannot escape, or their Females be parted from them in coupling time, or their Nests, or their Young be in danger to be destroy'd ; yet many sorts of Brutes neglect Self-preservation, and run any risque to pursue Copulation, preserve their Young, Eggs, Spawn, their Herd, Hive, &c. those things being of greater Consequence to Man than their own Beings ; and all this Instinct in such Creatures, is only to produce and preserve their Young, till they be fit for the Use of Men : And there are some Instincts in Man, to neglect his own Preservation for that of his Wife, Children, Parents, or numbers of People who are not his Relations, in procuring them Food, defending them from Dangers, &c. I think these Instincts are in the Body and not in the Soul, because it is not liable to want, or be hurt, or destroy'd, nor does it procreate, so can have no Instincts of affection to Relations ;

tions ; indeed it may be separated from the Body by other Agents, but if that be not by it's own Fault, or that of the Body, since God can know what that Being would have done, if the two Parts had not been unnaturally separated, he only knows whether it will be to their Prejudice hereafter or not. The Uneasiness and Decay for want of Food, and the Pleasure in the Taste of proper Meat and Drink, are not only a means to distinguish, but an Inducement to preserve our Bodies ; Neglect in Defect occasions Weakness, Sicknes, and in too great a defect, Death. The Loathing, Load, and Uneasiness, or Stupefaction from too much, is a sufficient warning when we have enough ; and the Consequences of Excess, as Fatness, Inactivity, Surfeits, Sicknes, and untimely Death, sufficient Restraint. Those who are guilty of Excess, make that Pleasure which was to induce them to eat and preserve their Bodies, an occasion to eat too much, or eat and drink things too highly refined, which tickle the Sense of Taste too much, and has not placed any Agents to tickle the Sense so much in Water, Air, or things common and most useful : And those natural Consequences of Excess, Debauchery, Quarrelling, &c, are not only

warnings to the Persons guilty to leave off, and to others to avoid such Courses, but of infinite Advantage to Society, by destroying those who will not live regularly, and making the Nature of the Things, nay, their own Hands, the Agents to punish them for those Crimes which the Civil Magistrate cannot reach. This Instinct was the principal Agent to drive Men into Society and keep them there, and make them obedient to the Laws of Society ; yet there is one Instinct which, directed by Revelation, makes them contemn what the human Laws of Society can inflict upon them for doing their Duty. And there is something which mimicks that highest of Virtues, whether it be Madness, or the Work of the Devil, which they call Enthusiasm, I undertake not to determine. But where either the Virtue or the Shadow happens, this Instinct is frequently suspended, whilst a Man believes he may be destroy'd, or cease to be, or be made miserable by human Power, so long as you have his Body, you have sufficient Security for his good Behaviour or Obedience ; but when once a Man is persuaded that he will not cease to be, and that nothing but his Actions can make him happy or unhappy, whether

ther you call it a higher Degree of that Instinct, or a Desire after Happiness, it makes him act as if he were clad with invincible Armour or were immortal. And though the human Laws and Power of Societies may confine his Body, or restrain his Actions, or put him to Death ; yet still as long as he does what he can to do his Duty, he acts not against this Instinct, because performing any one necessary Duty does not interfere with our Instincts to perform any other.

The Instinct in Man, be it in the Soul or in the Body, drives him to Homage and Thankfulness to his Creator, and to Dependance on him, how wide soever their Nations be of him, in despight of all the Attempts of practical Atheists ; and though those Acts be chiefly in the Soul, yet the Body cannot forbear to join, and as Man was to live in Society, the Body, nay, every part of the Body, was to act it's part for the Example and Incitement of Societies ; all the Dispensations were attested by Appearances adapted to Man's Senses, and all the Covenants and Sacraments between God and Man, were compos'd of spiritual Grants, upon Conditions by corporeal means, that the Performance of each Man might be visible to the Society : And tho' much Time spent in Prayer and

Repetitions, from single Persons to God who knows the Mind is useless, yet necessary in Societies, for Example, Union, &c. The several Sorts of Worship required, were to be perform'd not only by the Mind, but by the Body also for the same Reason : And Baptisms, Sacraments, &c. were to be perform'd before Societies for reminding them, &c. and God in his infinite Mercy hath appointed us a Mediator, compos'd of the Spirit and the Flesh, to promulgate his Will, atone for our Sins, govern and judge. The constant Dependance on God interferes with none of the Duties of Society, nor with none of our Instincts which lead us to them, and the Days set apart for publick Worship under the Law, were partly employ'd in reading and explaining the Law, which was made to induce them to observe the Duties of Society ; and he requires not more upon that account under the Gospel, nor ever intended that it which is adapted by all the sacred Ties and strictest Rules to make People act in Society, should, drive them out, and the Recluse who hinder themselves from paying their natural Duty to their Parents, which nothing can excuse, from propagating and educating Children, &c. which I think will hardly be excused by saying it is *Corban*.

There

There is in every Man Instincts that move him to Action and Rest, alternately to Conversation, to Curiosity, or Improvement in Knowledge, a natural Awe or Fear of doing any thing amiss foolishly, or which may disgrace him, and an Emulation to excel others; these seem to be auxiliary, or flow from other Instincts, and several of them are subservient to Virtues or Vices, as they are employed; and those we call Passions, which proceed from Instincts, and are auxiliary to them, such as Love, Fear, Joy, Hatred, Anger, &c. act from the Instincts they proceed from.

What Change of Instinct was made in *Eve* after her Disobedience, whether she was then first subject to *Adam*, and had Desire to propagate, bring forth, nurse, and educate Children by Pain and Labour, I undertake not to determine: But since Instinct to Procreation in Man, Woman, and Brutes, is the same, and the irresistible Desire placed in each Creature, attended with the great Pleasure in the Means or Action, was intended as a Bait to make them pursue the Means to procure the End; and it is equally a Duty in each Creature to pursue those Desires, and enjoy those Pleasures, which each of them only does, at proper Seasons; only in Man they are to be pursued and enjoy-

ed, without thwarting his other Instincts, which answer the Ends of Society, otherwise, if they tend to hinder the Ends of Society, they are criminal.

There is an Instinct in each Creature of each Sex, as well in those which regard not one another after the Act of Copulation, as those which live together for a Time; if there be Choice to chuse the most noble and beautiful of the Kind to couple with, to keep up the Dignity and Beauty of the Race; though there be the same Instinct in Men and Women, and an Instinct in them each to appear so, or assist their Appearance, by Dress, Ornament, &c. as the Mind, as well as the Body, is concerned in Society, Reason should assist to help to chuse one who is most likely to perform the Duties of Wife, Companion, and Mother best; but the bodily Instinct oftenest prevails. This Instinct seems not to be general; for sometimes there is something in the Frame of the Senses, or Mind, whereby one or both is adapted to be pleased with the Features or Actions of this or that Woman, as of this or that Friend, this or that Object, this or that Employment; and when the Persons, whose Senses and Mind is so adapted, happens to meet the Object in

in which there is that Agreement, the Instinct acts with Force almost irresistible; and sometimes the false Notion of Riches, Honours, &c. or false Opinions of Persons, and things over-rules this Instinct, and all the Assistance Reason can give. The End of this Instinct is answered among the wild Brutes, which do not chuse, by the strongest Male, becoming Master of the Herd, or, &c. and among the tame ones by Man's preserving the best Male, and gelding the rest.

Those Creatures, whose Spawn, or Eggs will hatch, and their Young provide for themselves, without the Assistance of their Parents, pair not; those whose Mother produces Milk for their Young, and has Gras or Food ready, without the Trouble of seeking it, provided for themselves, produce their Young at the Season when that Food is ready, and feed their Young with Milk till Food be ready for it, pair not; those which are tame, provided for by Man, and restrained from breeding, as Man sees fit, whose Females are most profitable, pair not, but one Male serves many Females. The Male and Female of most Sorts of Creatures, which procure and fetch Food for their Young, pair and keep to one another, provide for one another, the Male

for the Female, while great with Young, or each for other in Turns, while they are sitting or hatching their Eggs, and for their Young, till they are able and instructed to seek or catch their Food, and provide for themselves, which answers to the Ends of Marriage among Men and Women, because the Eldest of their Young are not able to provide for themselves, till the Parents be almost past Propagation, and the youngest sometimes, not till the Parents grow so old as to stand in Need of Assistance themselves.

All Females breed very young, some the first Year, more in the second or third, Woman breeds not till she be at Age to perform the Offices of a Mother; every Woman breeds not so constantly, because the Children cannot provide so soon for themselves; most other Females to within a Year or two of Death; Woman not so within thirty Years of the usual Time of Death, that the Children may be grown and instructed before the Parents die. Man begets Children at a much greater Age than Woman bears, because he is to make Provision for Wife and Children; because Nursing, &c. are Actions of the Body, instructing an Action of the Mind, requires more Experience, and may be performed much later.

Marriage

Marriage is absolutely necessary for Women, because otherwise, all the Trouble, Care, and Charge of educating Children, would lay upon them, and they are the only Creatures which are with Young, or whose Young are not able to provide for themselves before the Mother has more young; much more, who have several single ones, or Broods of young, before any one of them can provide for themselves; and because they require Necessaries and Education for a long Time, which becomes natural Ties to keep each Woman to one Man.

There is a Necessity, and it is a great Blessing that we should be born in a naked helpless State; and that we should continue a long Time in that State, and grow stronger and wiser by equal Degrees; and that the Mother should not be capable to provide for herself and her Infants: For if the human Race should have come to full Size and Strength in a Year or two, as other young Creatures do, they without sufficient Instruction, Experience, &c. whence the Use of Reason grows, would have made much madder Work than they do. Indeed, God could have given Man Powers of acquiring Knowledge faster, in Proportion; but those Powers were not found fit for this State; and if they had needed no Assistance, expected no Estates, &c. they

they would have been under no Ties to Parents, and would never have submitted to have been instructed, never obeyed their Commands, nor never returned any Assistance to their Parents in Sickness, or old Age ; and except their being born in this Condition, had obliged each Woman to keep to one Husband ; none of the social Duties could hold on both Sides, between Men in their several Relations, but every one of them would have been precarious ; the Father could have no Affection for the Mother, nor Love for his Children, nor would not provide for them, nor instruct them, the Children would not honour their Fathers, nor return Assistance to them, in Sickness, or old Age, as to those who gave them Being, fed and supported them whilst young, and educated them ; nor to their chief Parent, or Prince, as to him who protects their Persons when young, and their Persons and Properties when at Age ; nor would have no Affection or Regard to any Relations on the Father's Side.

Besides the supposed Choice, Consent, and Contract, each Person has a natural Affection for the Person, he or she first consummated that Contract with, and that Affection is increased from their joint Designs

Designs of begetting, nourishing, educating, and providing for Issue, by their joint Interests, Confidence in each other, Expectation of Assistance in Want, Sickness, old Age, &c. Besides their Duty by God's or Man's Laws, but false Reasonings and vicious Habits, sometimes deface, in a great measure, natural Instincts, and natural Ties or Obligations.

As Marriage is a Compact, without which neither Families, nor Societies, could subsist; and as the chief Article of the Contract is at the Discretion of the Parties, as when each of them performs their natural Instincts and Duties as aforesaid, those Instincts and Affections are heightened; so, on the contrary, where there is an Appearance of Want of Discretion, or Modesty, which is an innate Instinct, all slackens, as any of the Ends are neglected, especially in the Concern of Faithfulness; the Instincts and Affections are frequently abated, and few of the other Ends pursued; nay, Ground of Suspicion is sufficient to put a Stop to all: If in the Wife, Affection to her ceases, Inclination to beget Posterity weakens, because of Uncertainty; if any are born, the Husband's to nourish, educate, and provide for her and them; nay even to provide

provide for himself, frequently abates. To prevent this Crime of Unfaithfulness, Women have a Privilege which no other Female has ; for though they have a constant Instinct to propagate, they have it not in irresistible Degree at certain Seasons, because they are not to execute that Instinct, till they are contracted, and are to be governed by the Laws of that Contract ; and because, when they are contracted to one Man, he might be absent, or sick at that Season, and because they can provide for their Young at any Season of the Year.

And as the Females of most other Sorts of Creatures, have their Seasons of desiring to propagate, only suited to the Distance of Time of their going with Young, to the Time when Food will be provided for their Young, or Plenty to make them produce Food for them ; so the Males only have Ability to act at those Seasons, except only some few Species which are useful, tame, and in some sort, provided for, or assisted with Food by Man, when the Seasons do not naturally afford Plenty, and the Males and Females kept asunder by Man, whose Females are ready sometimes sooner or later than that Season, and whose Males act a little sooner or later, when the

the Females are ready for the Convenience and Advantage of Man : But Man has the Privilege for the Reasons abovesaid, to have Ability at any Season, when he is present with his Wife, in the best State of Health, &c. How far these Privileges are abused, is not fit to be mentioned ; and the Punishments which naturally attend those Abuses are proportioned to the Crime, such as Inability, Barrenness, Loss of Affection, Separation, Divorce, Shame, Contempt. Many Men over-power these Instincts to Marriage and Affections to Relations, by attempting to be wiser than he who gave those Instincts to them, and commanded them to pursue them regularly here, upon Condition that they should have nobler Instincts, and nobler Objects hereafter.

The principal Pretences for hindering Marriage, or suspending it, till it do not answer the End, is to acquire great Estates, and live high, that is, if they have not enough to live upon themselves, as they desire, and enough to spare, to provide for Children at first, as they think proper, they are not bound to endeavour to produce any : And the Men now, as they call it, of refined Knowledge, talk of getting Children, as to no other End but

but to heir their Estates ; and that those who have no Estates, ought not to get any Children : Others exclude themselves from Society, under a Pretence of acquiring Knowledge of serving God better than in the Manner he has directed : Others, that they be more holy and more at Leisure to perform the Offices of Priesthood, thereby neglecting all the social Duties of Propagation, to Relations, &c. and as much as in them lies, depriving an infinite Number of Beings, from being propagated in Time. If Creatures, which are for the Use of Man, should abstain, and not breed, what would Man do ; if Slaves, or Subjects, should take a Whim and not breed, what would the Masters or Princes say ; and if the Race of Man be designed for the Service and Glory of God hereafter, what Excuses will they make who have deprived him of Numbers of Subjects, or Servants ; was not this one of the Talents entrusted with them, and are they not to account for every Talent.

Indeed, it seemed to be the Opinion of the Apostles, that they might suspend Marriage, when the Destruction of *Judea* was at hand, and when the Christians were under those terrible Persecutions, that the Ends could not be answered, and that they

they might do greater Service to Mankind, by flying from Place to Place, and publishing the Gospel, which they could not do if they had Wives and Children, without breaking through the indispensably Necessity of providing for them, and perhaps some Excuses may be made by People who are Servants, or Slaves, or otherwise incapacitated to answer the Ends.

Whether those short Hints before the Flood of — *taking Wives of all that they chose* — and, *that their Children were mighty Men, Men of Renown*, — and *the Earth was filled with Violence*, were intended to express, that those Children born out of Families, not educated, instructed, nor provided for, were not to be govern'd by the Societies, but were the Agents of those Violences, I know not ; but it seems as if the Crimes of those Persons and their Issue, was the cause of the Destruction of them, and the Earth, at the Flood, or at least the cause of executing the Punishment at that Time,

There is in Parents, an Affection to their Children by Instinct, stronger in the Mother, because she is more certain they are her Issue ; strongest while the Children are youngest, when they need it most ; and strongest still to the youngest, because

because it needs it most ; for that reason left chiefly to her Care while tender and weak ; Satisfaction in taking Care and Pains for them, in conversing with them, even as well before they have the use of Reason as after : Pleasure in the Reputation of having Issue, and seeing them prosper, Expectation of having their Assistance in Sicknes or old Age, of preserving, or making their Memory famous, in paying a Debt to Nature, and something in respect of increasing the number of Beings hereafter.

Some of those Instincts are necessary in Brutes, and continue for a little Time till the young can live without Help. They are necessary in Parents, because though it is a duty to beget Children, and to give them Food, &c. yet it is in every one's Power, whether they will or not, and no Laws can compel them ; and it is necessary that their Affections to their Children, should contiue till Death, because Children are not able to leave their Parents of a long Time, nor fit to leave them, till they be instructed ; and the Affections by Instinct follow, if the Parents act naturally they love, though the Children give no reasonable occasion for Affection, whether they be beautiful, wise, grateful, or not ; and can

can hardly be overcome by Reason in the greatest Provocations; in whatever else the Image of God in Man consisted, or what Parts soever were defaced, at the Fall, *Adam* and *Eve* being intended to be Parents, had natural Instincts to procreate and provide for their Off-spring, with the Powers and Means God had given them, at second hand, as God created, provided for, and endeavour'd to make them his Off-spring (as the Apostle calls them) happy. And this Instinct, or Affection, runs downward to the Successions, born or to be born; and some think for that reason, that the eldest Father has a right of governing or directing all those descended directly from him, in Affairs which relate to the Family, and of instructing and advising them in every Thing; nay, some will carry it so far, that this Affection, and Pre-eminence, and Authority, goes along with the eldest of the eldest Line, of which more afterwards.

The Obligation among the Jews, to marry the next Relation, not prohibited, was a means to keep the Tribes, and their Inheritances separate from one another, and perhaps, those nearer were prohibited, because the Familiarities among Relations in the same Family, would be

a great Temptation to Irregularity, if Marriage were not forbidden among them ; and the suspicions which would arise thereby upon Women, bred upclosely in their Fathers Family, or in those of near Relations, would make them not so much to be regarded by virtuous Men upon that Account.

Perhaps marrying near Relations, was prohibited because the Ties of Affection between the Relations was sufficiently strong, and Intermarriages being a sort of Alliances between the Relations on each Side, and marrying those which were not already ally'd, was a sort of an Engagement to bind Families more strictly in Society.

The Earnestness to obtain, and Pleasure in procuring, Provision for Issue natural, and made an Inducement to take Pains in doing it, as Pleasure is made an Inducement to procreate them, and both are right, if rightly apply'd, and no other Duty be thereby broke through. Some Beasts and Insects gather Provision in the Summer, and lay it up in Store for themselves in Winter ; and many Creatures make Dens and Nests to preserve their Eggs and Young in ; but I do not remember that any Sort lays up Provision for their Young, either before they are born, or hatched, or after.

As

As the Earth produces successive Supplies, and every Race of Man is bound to provide for their own Issue; hoarding Estates for selves and Issue, more than necessary, is providing us and them Fuel, for our or their inordinate Lusts; and when we have enough, the pretence of providing for, or raising a Family, does not discharge us from our Duty of relieving the Poor, which Relief the Poor has, though in a lesser degree, the same Right to from the Rich, as Children have of Provision from their Parents. of which more hereafter.

Besides all the natural Assistance from Parents to Children, such as nursing, conversing with, instructing, &c. and thence most of the reasons why Relations have Affections to one another, is supply'd by Strangers, for those who have great Estates; and therefore those Affections are generally less among the Rich, than among the Poor; and Children are not immediate Debtors to their Parents, but to those who got the Estates, perhaps ten Generations ago; and Mothers who quit themselves of the trouble of nursing, conversing with, and taking care of their Children, quit their Children, as far as in them lies, of the Pleasure of loving, and

themselves of loving and being beloved by their Children; and Fathers who leave the Conversation, Instruction, and disciplining of their young Children to others, have Returns accordingly, and the most they can reasonably expect from their Children, is to have a Nurse, Servant, or, &c. to look after them, when sick, or aged, &c. so the one loses the tender Care of their Parents, and the other, the dutiful Returns of affectionate Children; and whether those, either Parents or Children, who free themselves from the Duties of Families or Societies, by acquiring or enjoying great Estates, have the better of those who do their Duties, Time must discover.

In case of decease of Parents, while Children are young, the Care of their Education devolves upon the next eldest Relation, unless granted by the surviving Parent to some other. If there were no Estate, naturally on the Father's side, if an Estate of the Mother's side, which cannot inherit, except the Estate be the Inheritance of the Mother, and then to the next eldest Relation on the Father's side. *Quær.* If Estates descend on each side.

If these Instincts had not been very strong, 'tis easy to imagine, what would have

have become of Infants ; Especially one would have suppos'd among the poor People, who are forc'd to labour hard to provide Necessaries for themselves ; but so little share has Education, or Knowledge, in this Affair, that a brute Creature, or the most ignorant of human Race, will venture or spend their Life, rather than part with their Young ; whilst the most polite will trust their young in the Hands and to the Care of a Person they never saw before, rather than dirty their Cloaths ; and if the Desire of, and Pleasure in, begetting them were not much stronger, they would leave that Trouble to others also.

Reverence and Affection from Children to their Parents, is partly by implicit Instinct, and partly by the Instinct of Gratitude, as they are parcel of their Parents, have been begot, nourished, protected, educated, and provided for, by their Parents. This continues only in Brutes, till they are able to provide for themselves, and after that, they regard not Parents nor Relations. In human Race it continues till Death, to the ends aforesaid ; and that Affection to their Persons by Instinct, if their Parents use them never so cruelly, continues, nay, even if their Parents were distracted ; nay, even that

Honour, Reverence, and Obedience, commanded by God, proceeds so naturally from Children to their Parents, that even Ignorance, and all Vices join'd to it (except the diabolical Sin of Pride) cannot deface the Impression of those Duties in our Minds, whatever they do in the Performance; and whenever Children do their Duty, there is an inward Satisfaction attends it, as an Inducement, as there is in performing every natural Duty, where there is neither Religion nor Policy; these Affections abate upon suspicion, that the legal Father is not the real Father, and devolves upon the supposed Father, and in cases of uncertainty is suspended, whence arises the necessity of one Woman keeping to one Man. If filial Affection were not chiefly by Instinct, as the case stands now, when Estates are settled chiefly upon the eldest Son, and that thought too little to keep up the Families, whereby they indeed make him Lord over all the rest; the younger Children would be weakly bound by Gratitude. These Instincts or Affections, are equally necessary for the preservation of the young of Brutes and Men; for if they were not obedient to the Call and Directions of their Parents, during their Ignorance, few would escape being destroy'd

destroy'd by other Agents, by Accidents, or by themselves; and though Brates do not take care of their Parents when aged, and past providing for themselves, because that would be of no Service, but a Detriment to Man; yet if these Instincts were not strong, and the Ties of Gratitude great among the Poor, where there is no Provision but Labour, either for the young or old, what would become of the sick or aged Parents.

This Instinct in Families runs much further, than to private single Families, to a greater Confidence in Relations, than in Strangers; and further still very remarkable among the ancient Tribes, Clans, and Kingdoms, named each from their common Father, not only in joint Interest and Affection to another, but in Reverence and Subjection to their Chief; and so in Subordination to the Heads of younger Houses; so that in the same relation, as natural Children, had each to their respective Parents, each Tribe had naturally to their Prince, in a political Sense.

Besides the Necessity of living in Families, and performing the Duties therein, there is a Necessity from the Nature of things, that Families should unite together into Societies, and that each Member of

the Society should be bound to perform his Duty therein, in order to their living safe and comfortably here ; because Man's Armour, offensive and defensive, consists in Instruments and Materials contriv'd, procur'd, and employ'd, by Numbers of Hands, to protect them from being devour'd by ravenous Beasts, Birds, amphibious Creatures, Fishes, &c. to protect the useful Creatures from them, to destroy them, &c. to protect their Bodies, Wives, Children, and Servants, their Property, in Lands, Goods, &c. against ambitious Princes, Murderers, lewd Persons, Robbers, Thieves, &c. that the many things necessary for the Support and Convenience of every one's Life, may be procur'd by the joint Knowledge, Industry, and Labour of great Numbers of different Abilities and Employments. To preserve the collective Knowledge of former Ages, to instruct Youth, to cultivate the Earth, manufacture it's Products, to govern the Societies, instruct in matters of Religion, in procuring Remedies for the Sick, &c. and to advance that Knowledge by the Information, Examples, &c. and that the joint Body, or the Wise and Rich, should employ the Ignorant and Poor, and make their

their Labour support themselves, and become a Benefit to the whole.

And as Men at their several Ages, and in their several degrees of Capacity, strive to get Liberty to follow the Dictates or Conclusions of each their own Reason, whether their Evidence be true or false, whether their Conclusions be truly or falsely drawn, whether their Reason be bribed by overvaluing some things, or prejudic'd by undervaluing some other things, whether they understand how to use their Opticks to view things at each Distance in their true Magnitude, or to take the things nearest to be largest, and as some sometimes want to supply Nature, some to supply irregular Desires, thence arises necessity of Instruction and Restraint by Government of Parents whilst young, and of Princes, &c. when at Age; and each Person of each Sex has Instincts, Capacities, and Ability to perform each their several Duties in Societies, as they have in a Family; each to perform the Duties in a Family, and they are to contribute jointly to perform what every Family does privately, in the same Order of Preference with the same Care of those incapable as of Infants, and so in Degrees.

The

The natural Instincts which every Man has, are adapted for Society, and for every Man's good in Society : The Duties enjoin'd in the Gospel are all founded upon natural Instincts, those to God as to our Father, Feeder, Protector, &c. those to our Relations as Father, Brethren, Wife, Children, &c. and to all the Race of Men, as God's Children and our Brethren. Society itself is fram'd for the Good of every one in the Society ; and there is not one Family or social Virtue, but it has it's natural Reward, nor one Vice of either sort, but it has it's natural Punishment. One of the principal Uses of government in Society, and which is a Duty most strongly inculcated in the Gospel, is, that each Member should refer their Claims or Injuries to be determin'd or righted by the Head of the Society, and not take upon them to judge for Right, or revenge themselves ; and that after such Reference, each should sit still, though they cannot get Redress against their Fellow-Subjects, or against the Head, as Children in a Family refer all differences among themselves to their Father, without Appeal or Force, to prevent the horrid Consequences of Strifes, Broils, and Tumults, among inferior Neighbours; and of Civil Wars and Rebellions.

bellions. Those Societies which pursue these Instincts regularly, as they are laid down in the Christian Religion, would be upon the best foot imaginable, they would be inoffensive, kind, and assistant one to another, and resolute upon good grounds, to defend themselves against any other Prince or Society, who should offer to do them Injustice. Nay, things are so well contriv'd, that some of the irregular or extravagant Appetites of Men, are conducive to draw People into Society, and keep them employ'd in the Proportion design'd. Inclination to Variety of, and Curiosity in, Meats and Drinks, are Inducements to draw Men in, and continue them in Society where such can only be procur'd. The Desires of the Rich after rich Metals, Stones, Rarities, and Delicacies, which seem inordinate, and for which there seems little real Occasion, make more Employment for Men, &c. and make some Societies of Men, where there is Plenty of Products unite in force of Shipping, &c. to seek and fetch those Things from distant Parts; others join in Societies to inhabit and cultivate those Countries where they are found and produced, to dig and produce them, and those Inhabitants of Countries which produce few Necessaries

ries, procure the Products and Manufactures of Countries, which yield Superfluities, in exchange for those useless things which makes one Society emulate another, propagates Improvements, Science, Religion, &c. and gives Men a larger View of the several Works of God, below and above.

In Societies, some Persons by too much Industry or Covetousness, employ the Hands of the Poor, in Improvements, Trade, &c. upon too hard Terms, over-reach the Ignorant and feed the Extravagant to acquire Estates; and some of their Successors often in a short Time, employ the Poor in procuring them Supplies for their Extravagances, are over-reach'd by the Cunning, and fed by the Covetous upon extravagant Terms to spend their Estates; so that both keep the Industrious employ'd, and the latter prevents too great abundance.

Whether Curiosity increases with Riches, or Man's Curiosity be boundless, I know not, but generally the richer they are, the idler they are, and the more they have to spend, the more costly Things they desire; so that the idle extravagant People are made a means to keep the Industrious more fully

fully employ'd, perhaps in that Degree which is most for their Advantage.

The Desire of strange and various Fashions in Women, who will not employ themselves about any thing useful or necessary, makes them employ themselves and others, who want to manufacture and sow things, suit their Humours, and in some measure employ their Minds, and prevent the consequences of Idleness.

And though the extravagant whimsical People, intend not the Advantage of the Poor, 'tis better for the Poor who can labour to earn Money, for labouring about Fashions or any trifles, than that the Rich should give them so much Money to live upon idly; because, besides what the Rich who want Employment do, those who have been bred up idly, and fall into Poverty, will not labour, and those who have been bred up poorly and idly, will not labour, and those who have been bred up to labour and want Employment, naturally fall into irregular Courses, and 'tis the greatest defect in Government to maintain, or suffer any who have not Employment to live idly.

Since Man is intended to be a Subject and sociable Creature hereafter, and is to be fitted for that State here first in Families,

milies, and after in Societies ; and since this State is an Image of that hereafter, wherein is represented, though imperfectly (as all our Representations of hereafter are) the Affection of God to his Children, by the Affection of Parents to their Children, and by the Affection of the chief Parent to his Subjects, the Honour and Reverence of the Children of God, by the Honour and Reverence Children and Subjects pay to their Parents or Sovereign ; the Charity or universal Affection among the Children of God, by the Affections and Love among Brethren and Subjects, could it enter into the Heart of any reasonable Creature, before he had first renounc'd hopes of hereafter, to imagine that God, after he had fram'd Man, and every Thing else for Families and Societies, would not imprint Instincts, and lay down Rules by whom, and how, those Families and Societies should be govern'd ; or that he would leave it in their Power to run wild, or to choose such Governoers as they pleas'd, and consequently to be govern'd as the strongest Party of every Society pleas'd, leave his Families, either small or great without Stewards, and leave them to choose Stewards themselves, accountable to themselves. The —— when they

they rebell'd, follow'd their chief Leader who was set over them, but never attempted to choose one that we know of.

Since Society is absolutely necessary, and they cannot subsist without some Government, whence did right of Dominion properly, &c. arise. God created but one couple of human Kind, and the Earth, &c. brought forth doubtless, many couples of every other Sort of Creatures 'tis likely, because if there had been several couples of Men and Women created, besides the Difference it would have made in respect of their Probation and Fall, those Couples and their eldest Descendants would have claimed Equality, and they would have been at perpetual Strife and Contention for Superiority, and would not have had the same Affection to one another, as those who descended from common Parents.

God created the Earth, and gave *Adam* the Soil, and Herbage, and Dominion, and Power, over his Wife and all Creatures, and he saved *Noah* and only his Family, perhaps for the Reason aforesaid, and gave them the Earth, &c. and *Noah* had Superiority over his Children, that will not be denied, for he exercis'd it presently after.

If

If there had not been Instincts imprinted at the first in the Race of Man, next after God, to obey their Parents, and in the Brothers to obey the eldest Brother, and so according as they took Place by Seniority, or Primogeniture; and those Instincts had not been reminded or enforced by God, these to Brothers, when upon the Grudge *Cain* bore *Abel*, he said to *Cain* — *Unto thee shall be his Desire, and thou shalt rule over him* — in the same Words as he gave *Adam* Power over his Wife; and the Right of the Father had not been exercised by *Noab*, and the Right of Sons where the Father makes no Alteration, described; and shewing that it was such a Crime for a Son to expose his Father, when deprived of Sense by his own Fault, that he was made a Servant of Servants, a Servant not only as he was naturally to his elder Brother, but contrary to the Order of Seniority to his younger Brother, who was naturally Servant to his eldest Brother, and superior to the youngest, whereby the Superiority of the eldest was occasionally confirmed, that of the youngest raised, and the second judicially debased: And afterwards, when God enforced, or reminded them of the parental Right, and the natural Rewards annexed,

annexed, in this World, there could have been no Families, or Societies, naturally formed, no Right in Nature to govern them, nor no Obedience would naturally have followed, without divine Direction supernaturally, by nominating a Person to succeed, at the Decease of every one so appointed, in every Family, or Society; and leaving the Execution of those Powers, which are naturally necessary for the Preservation of Families, or Societies, uncertain, or to be determined by the unnatural Methods of Division, or Force, either who should be the Persons, or in what Manner they should govern, would have been leaving a Cure worse than the Disease: The most ambitious, richest, or strongest, would have been Governors of every Family and Society, they would have had no natural Affections for those, they should so gain Dominion over, nor those they had so gained Dominion over would have no Inclination to obey them. Brutes, as has been mentioned, leave off their relative Affections one to another, as soon as the Young are able to provide for themselves; and the strongest is the Master of the Herd, or, &c. of the same Sort. But Mens natural relative Affections continue till Death, for the Ends aforesaid;

and those who suppress them, and are said to be without them, are called brute Beasts, because they do as Brutes do. And some Sorts of Men, are frequently compar'd to Dogs, which, though an useful Creature to Man, I think are accounted the vilest ; because though all other voracious Creatures, only kill other Creatures which are Food for them, and when they want Food, and seldom destroy any of their own Species, except it be in Quarrels for their Food, or for the Females, or in pursuit of other natural Instincts, nor any other Sorts of the voracious Kinds, which are not Food for them ; yet Dogs, besides killing for Prey, or pursuing their natural Instincts, are to be bribed so far, by the Person who feeds them best, even when their Bellies are full, that at that Person's instigation, they will fight or destroy any Creature, not only those they naturally prey upon, but even their own Species, or those other voracious Species, nay any other Man. And those Men who act for Bribes, or at the Instigation of others, contrary to their natural Instincts, are so term'd. But to return to the Question.

How did *Adam* or *Noah* bequeath what was granted to them, or if there was Bequest,

quest, if it descended, how did it descend, if there was no Difference in Right by Descent, how was it divided?

It may be said at first, there was enough of Earth and things thereon, for either of them and their Sons, there was no need for two of them to choose the same Place or Things; 'tis true, but it does not follow, but that two Persons, who each has too much, may be most likely, and oftenest do contend for the same Place or Things. And as all wise Instituting make Provision for what might happen, if it did happen so, who was to divide or determine the Right between, or among them; could not Nature appoint some Person who had natural Affection to them all, and invest him with Right, to give any Place or Thing at first and afterwards, any Place or Thing, which was not given or possesst, and Power to determine Disputes, and secure the Title to any Part of any Place or Thing, in each of those Places which were so given and in Possession, and could not that Right be given or descend, and be divided among Persons so qualified? Was there a Necessity, for the sake of Freedom or Liberty, that they should live like *Hottentots*, that nothing but what each laid his Hands on, eat or

drink, should be his own, or that the Possession and Right should be determin'd by the same Law, as determines the right of Bears ? What is it makes People run out of Society, or oppose the Orders of their Prince ; is it not a supposed or pretended Equality or Freedom, would not this natural Superiority in Families or Societies, have removed this Pretence. Could Children have desired a fitter Person to divide the Estate among them than their Father, tied by natural Affection ; and could there be a greater Security for the good Behaviour of the Children, during the Life of the Father, added to the Obligations of giving them Birth, nourishing, feeding them, &c. whilst young, than the Power of leaving the Estate among them, as he pleas'd at his death ?

If the Father made a Settlement or Will, who was to determine any difference about that Settlement or Will, had every one of the Sons equal right to determine it ? If the Father died without a Settlement or Will, were the Sons all equal, was each one to have an equal share of the Earth, or what the Father died possess'd of; if so, who was to execute the Settlement or Will, or divide the Shares, was it to be done by Majority of Votes,

or

or if two or equal, who or which was the Majority; and if the Father died while they were young, or before they were at Age, when Man lived near a thousand Years, when were they at Age, when had they Right to Vote; and if not at Age, who was to act for them, could any one of the Brethren be a fitter Divider, Determiner, or Guardian, than the eldest, who must be suppos'd to be, as eldest, the wisest, strongest, &c. and a natural Guardian for the rest?

If they had been all equal, and two, or any number of Children, had agreed to divide the whole, or any part, and had made Renuntiations, and any difference had arose afterwards among them about that Division, who was to determine the Difference? If it happen'd while the Brothers were alive, they would be still equal, if after any or all of them were dead, the Posterity of each of them would be equal. If the Difference happen'd among the Posterity of any one Branch, about a Subdivision of their Share, they could have no Right to determine among one another, nor the other Branches could have no right to interpose, except by Mediation, and no Dispute could be determin'd, without Divine Interposition, but by Force. If there had been no Right suppos'd, would not they naturally have

made the eldest of the eldest Branch Referee, would not the reasonable Men naturally have wish'd for such a Referee, and could the unreasonable desire one better qualified, than one who was in the Place of common Parent, endow'd with natural Affection to them all, &c?

But perhaps it may be said, that at first they could only bequeath, or take by Descent or Division, what they had possess'd, or had seen, or knew of; if so, had the first Finder, Discoverer, or Enjoyer, Right to keep, or assign, what he so discover'd or enjoy'd? And had they Right to defend that Right of Discovery or Possession by Force; or how, or if any Dispute about the Discovery or Possession arose, who was to determine it? If there was no superior Person to determine the Right, then the greatest Force must establish the Right, and that Right acquir'd by Force or Power, could subsist no longer than whilst that Power was greatest, for a succeeding Power which was greater, would have the same Right.

Whence had Men the Right to use the Sword against one another; which of them had it, and how, and when came it to those who had it? Cain, who was Heir apparent to the World, whether it was

was because his Father was alive, or for some other Reason, had not that Power over his younger Brother *Abel*; and yet he was conscious there was some Person which he did not think fit to name, but call'd *every one* who had Power to use the Sword, and put him to Death for Murder. Who could that Person who had that Power be, was there any other Man but *Adam*, if *Adam* had been dead when *Cain* slew his Brother, could younger Brother, or his own Posterity, if there had been any, have put him to Death?

If *Adam* or *Noah*, gave either of their Sons Possessions, during one of their Lives, they might give them Power to defend each their Possessions, against one another, but not against their Parent; if he gave them Possessions without Power, the Power of defending their Possessions, must devolve after his decease upon the eldest, and he was to defend even with the Sword, against such as invaded his Property, or offered to rival him, or dispossess him of his Power. If the Father gave each, or any of the younger Brothers Possessions, independent of the eldest, with Power to use the Sword; or the eldest, after the whole devolv'd upon him, gave each or any of the younger Brothers

Possessions, &c. Power independent of himself, they each had Right to use the Sword against each other.

If that Right was not in the common Father, and descended to the eldest Brother, or such as they, or one of them gave it to, but descended equally or in common among all the Brothers, then that Right would descend from each of them to their Sons, and each of them would have the same Right as their Fathers and Uncles had, and so that Power would be in every Man.

If so, and all the Brothers agreed to vest this Power in one, either for Life, or upon him and his Issue, this was presuming a paternal Right in each of them; otherwise, the Children of any of them, at least after their Father's Death, would be free from this Agreement, and the Electors who were naturally bound to preserve themselves, would not discharge that Duty, by transferring it to another, and giving him a Power to destroy suppos'd Offenders, which they themselves would not have done.

If only a Majority of the Brothers agreed to vest the Power in one, or one Family, either the rest must be independent, else this was imposing a Force upon them,

them against their Right, and without their Consent.

If the Act of the Father binds his Posterity, or the Act of the eldest Son binds the rest, or the joint Act of all the Brothers, or a Majority binds them all, and their Posterity, either absolutely or conditionally, if he or they make the eldest, or any other, Supreme absolutely, there can be no further Dispute, if conditionally, who is to be Judge of those Conditions; if the Supreme, he is absolute; if the younger Brethren, or his, or their Posterity, the eldest, or Person elected is Tenant at Will, and the Posterity of the eldest, or of the Electors, have Power to use the Sword against either of them, or the eldest of either of their Lines at Pleasure.

A Father may advise or reason with his Children, but the sole Right of directing or commanding is still in him.

If that Power was once in one, and did not descend equally, then either the Will of the Father, or the Grant of the eldest Brother, and his Renuntiation must be valid, or else that Power had been continued all in one Hand.

Though Property without a Charge, may be alienable by the Owner to any Person,

son, it seems as if a Charge, or Property, with a Charge, is not alienable, but only resignable, and devolves upon the next proper Person, as the next eldest, or, —— &c, because the Right is not solely in himself, but the Subjects have Right to be govern'd by that Line, or, &c. in Succession.

If first in Possession, &c. had the Right, then Power, Property, &c. was in the common Father; if the Children had no Right, but what was given or descended from him, then if he gave or divided the whole, that Division was good, if he left it undivided, either it belong'd all to one, or equally to all, if equally, all Men are equal now, in respect of Right and Power, whether they be consider'd as having made a Proxy, or acting themselves.

If the Earth, Power, &c. were in one Hand once, and divided by Gift, Descent, or Division, among the Heads of the several respective Lines; then if any Part were not enter'd upon according to that Division, and that Division do not appear, nor no Claim since, it either lies in the Line of the eldest, or in the Prince whose Subjects first discover it. And if any body of Men, without Licence from their Prince, take any Part of the Earth which

which is not possess'd, and exercise such Power, 'tis &c.

Thence it will follow, where a Person or Persons, are found in Possession of Power or Property, and none can disprove it's being legal, or shew better Title, that Possession must be a good Title.

Since the Defence of our Persons and Properties which seems so natural, is one way or other got into the Hands of the Prince, and that he is to determine all Disputes among his own Subjects, how came the Right of one Society, disputing their Right with another Society by the Sword, if this Power was not once in one, and came down by Division and Descent, either naturally or by agreement of all, how came it, will the Opinion of a Number of People, or their Judgment in their own Cause, warrant them to destroy People, who were no ways subject to their Agreement and Laws, upon pretence that they grow too great, and that thereby their own Lives, Liberties, and Properties, are endanger'd; or that they have broke Promises with them, or, &c? This seems to be a sacred Prerogative, not fit to be trusted in the Hands of every Man,

Man, much less into the Hands of their Proxy.

If Parents can bind their Posterity, by performing Homage, Allegiance, or Duty, or by acknowledging Right or Compacts, the Subjects of several Princes who compose Commonwealths, were bound by Allegiance to those Princes ; if they cannot be bound by what their Ancestors did, their Posterity are not bound by what they do.

And if these People have Right to choose Governors, they have Right to refuse to choose, and consequently to be govern'd ; and since it is not naturally determin'd who have Right to choose, nor when they have Right to choose, so as when their Father is alive, or when they are at Age of Discretion, or when that Age is, because the Life of Man has been varied, from little less than one Thousand, to less than one Hundred, or when they are married, or when they are Fathers, or when they are possess'd of any Quantity or Value of Lands or Goods, and can never be determin'd and ascertain'd by any settled Rule, and if it could be determin'd, which of them had Right to Vote, and there should be ten Candidates, then he who should have one Vote above

bove one Tenth, supposing them so divided, would be chosen, and consequently an Enemy to all his Rivals and their Voters, and they would be about nine Times as strong as he, and his Electors could not support him ; and if there should be but two Candidates, what Foundation is there in Nature, that either he that has the greater Number of Votes, or he that has the Majority, should have the Power to distribute Justice between those who voted for him, and those who voted against him, whether they be nine Tents, or a Majority ; nay, where not only Natives; but a Foreigner in the Interest of another State, and by their Assistance, by Bribes, &c. may be elected, or if not elected, dispute his Pretence, by the Assistance of Foreigners, Money, or, &c. so this Power advantageous for a Society, does it not generally end in their Destruction, will he have the same Affection, and administer Justice, like one that supposes himself in the stead of the chief Parent of the People ?

If one chosen can by conferring Titles, &c. and give Power to others to choose his Successor, he can give that Power to one, and so nominate his Successor. Besides, Disputes among Elections and Titles,

tks, makes whole Nations Enemies one to another, makes the Person elected an Enemy to those Nations who oppos'd his Election, in War, Trade, &c.

And if all the Persons who compos'd one of those States, were equal, one of them, when he had committed a Crime, could not judge, and put himself to Death for that Crime, how could he authorize another to do it? nor could he make War, &c.

Liberty for Subjects to desert, set up States, and choose one another to be Governors, shelter those who rebel, or are disobedient, or desert their Allegiance, or are unwilling to pay their Debts, or have disengaged their Parents, robb'd them or their Country, could never be intended for the Good of Families or Societies.

Some pretend to say, that to prevent pyrating by Land or Water, and all the evil Consequences of a mixt People, it was intended, that they should first be in small, and after in greater Families, that they might be each under their natural Heads, each have natural Affection, Reverence, &c. that some were to hold *in capite*, and the rest of them, &c.

Others say, why should Children be subject to their Parents, and why should such

such great Numbers of People be subject to the Will of one Man. I'll add, why were we put into a State of Probation, was not one chief End, to learn to be subject ; and if all Magistrates did their Duties, and encourag'd Virtue, and none obstructed, there could be no suffering publickly, or giving publick Testimony for the Truth, for doing their Duty, &c. which is the highest Honour in this State.

And notwithstanding the Objection of the Abuses of Power, if there was not such a Power in the Prince, as there is in the Parent, to punish at Discretion, such Crimes as cannot come within the Compass of Compacts or written Laws, such as derogating, by Wards, &c. from the Authority of God, Parents, and Princes, ridiculing the natural Ties of Relations, &c. and that Power be not exercis'd, Custom by Degrees draws them on, till they commit greater, and deserve expulsion out of Society, or Death ; and there seems to me, to be no other way to reclaim the unnatural, irreligious, and blasphemous Liberties of this Age.

Our Senses convey Ideas or Images of Things, or Actions, to the Soul naturally, without Information, Instruction, or Experience in all Men, in the same Manner,
but

but in different Degrees, to know how the Senses perceive, or how they convey their Perceptions to the Mind; or how they act is of no Use, because we cannot alter their manner of Action, nor if in Health, improve them, except in some few Cases, where Glasses represent Things nearer than they are, or greater than they are, hitherto of little use, to know what obstructs any of their Actions necessary, because sometimes we can remove those obstructions.

Those Ideas each of them raise or frame the same Kind of Affections naturally in the Minds of all Men, but in different Degrees, and those Affections may be suspended by Reasoning or Art, but cannot be erased, and how those Affections are imprinted, is of no use for us to know.

The Powers, or Capacities, or Abilities of the Souls or Minds of different Persons, or the Assistance they have from different Bodies, make them generally differ; and some of their Powers, or Genius's, are frequently capacitated, adapted, or bent to act best in one Sort of Knowledge, some in another, scarce any Person has more than one Talent, in any considerable Degree, scarce in an extensive Capacity,

pacity, and clear Expression : Whether it be in their Capacities, or in their pursuing one thing chiefly matters not, but by this Means, each has a Dependance on others. Of what use would it be to Society, that every one had equal Talents to acquire Knowledge, nay, what use would it be either to those who have great Talents, or those who have not.

What the Soul is, how it adheres to, and acts with, the Body; how the Organs communicate Ideas to it, how it acts, is fit for him who created and supports them to know, but of no use to us.

The Abilities of the Senses and of the Mind, were limited, and proportion'd of Degrees sufficient, to enable Man to do his Duties, and in different Degrees; in general to prevent Man's Pride, keep them in an humble submissive Dependance on God, and in particular, in Dependance upon one another, in their several Orders; and Reason was intended to be strong enough to assist in providing for our Bodies, to limit and bound our Instincts, or the Passions which flow from them, and enforce us to perform our Duties regularly, and orderly, not to hinder us from doing them ; and the Instincts of the Mind were adapted, or bent, to take Pleasure in the

Means, which lead or drive him to the Pursuit, and in the Accomplishment of those Duties, and not to amuse or divert him from them, so Instinct is, to know how to procure, and use the Things below, in the Proportion they were design'd to be us'd in. To inform us of so much of their Motions, Actions, or Properties, as is conducive to that End, to know what Matter is, how God gives it those Motions or Qualities, further than for the Uses aforesaid, is useless.

The Mind was made large enough, and has Information enough to know, that God was Good and Great, and that pleasing him, was the Means to make us happy; and that that Happiness would be sufficient; to know what God is, how great he is, what that Happiness is, how great it is, is needless, and inconsistent with this State.

Those different Powers, or Faculties of the Mind, are improv'd in general, in Proportion to the Information, or Experience, or the greater or lesser Sphere, their Bodies move, or have Opportunity to observe, and act in; in particular, according to the Experience or Observation they have had, or made upon, that Thing, or in that Study.

Of what Use would it be, that Knowledge should come to all, without Instruction or Experience, is it not enough, that he who has Abilities, and studies this or that Science, follows this or that Employment, should be expert therein ; would Society go better forward, if every one were qualified to be a Divine, Lawyer, General, &c. who would labour ?

The Manner of the Mind's acting, is by retaining the Ideas of Bodies, that have rested, moved, or acted, within the Sphere of the Senses, and of the Consequences of their Rest, Motions, Actions, &c. and of the Actions of our own Minds, or of the Actions of the Mind of others, within the reach of the Senses, and recalling them, and by them framing new Ideas of such like Bodies or Actions, and of their Consequences before they be put in Action ; and we can in Idea, annex Things together, which we have not seen together, add Figures, &c. to Bodies, which those Bodies had not, imagine Actions, differing in Circumstances, from those we have seen, Agents acting, which do not act, performing Actions, which they do not perform, extend or diminish those Bodies or Actions, beyond those Ideas retain'd of such like Bodies or Actions

tions, but cannot raise or frame any Idea of Body or Action, which has not been let in by our Senses at once, or in several Parts, or in greater or lesser Degrees: Of what Use would it be to us, to have our Heads filled with Images, or Ideas of Things or Actions, of which we have no Knowledge nor Certainty, of their Existence, or of having been perform'd, or that they ever will exist, or be perform'd.

By retaining Ideas of the Actions of our own Body, or the Parts of our own Body, or the Bodies or Parts of others, and of the Effects of those Actions, we frame Ideas, of the Actions of our Bodies, or the Parts of our Bodies, and the Effects of those Actions; and foresee what Effects such Actions will produce. To know what moves our Bodies, or Parts, or how it moves them, and how that Power of Motion is directed, is of no Use to us, unless we could improve that Direction of Motion; to know what obstructs or diverts those Motions is useful, because we can sometimes remove those Obstructions.

By retaining the Idea of Action, and of the Pleasure or Pain, this or that Action of the Body conveyed to the Senses,
to

to frame Ideas which incite us to pursue the one, and avoid the other.

By retaining Ideas of Actions of the Body, and of the Pleasure which some painful Action has produced afterwards; to frame Ideas of the Pleasure afterwards to induce us to undergo the same, or such like painful Action; and by retaining the Ideas of the Pain after some Action of Pleasure, to frame Ideas to make us avoid that Pleasure.

By retaining the Ideas of the several Sounds formed by the Mouth, and the Things they represent: To frame such Sounds to convey Ideas of Things to others, or receive Ideas of Things so retained from others.

By retaining Ideas of Characters which raise or frame Ideas of Sounds, which raise Ideas of Things, or Actions, we keep for ourselves, or convey to others the Ideas of Things or Actions we once have had in our Minds, and I think no other.

By retaining Ideas of bodily Actions, and of the verbal or written Laws which require or forbid them, and of the Rewards or Punishments of such Actions, we frame Ideas to direct our Actions, to acquire the Rewards, and avoid the Punishments.

By retaining or recalling Ideas of Bodies at Rest, in Motion or Action, and of Distances, Actions, Circumstances, and Accidents, and comparing and considering them in Idea, the Mind can shift and alter, and apply those Ideas to other Bodies, and view how they would appear, and be, when in Reality, and know by former Experience, and those Comparisons how to move Bodies, how they are moved, what Effects or Consequences will follow.

By retaining the Ideas of the Figure, Dimension, Consistency, or Solidity of Bodies, and of their Parts when divided, and the Figure, Dimension, &c. of those Parts, and of those Bodies or Parts united one with another in other Dispositions, we frame Ideas of other Bodies entire, of their Parts when divided, re-united, or mixed, and know what new Figures, &c. Bodies, or the Parts of Bodies, which have not been divided, united, &c. will produce.

By retaining, or recalling Ideas of the Size, Figure, Qualities, and Properties of Bodies, we therewith frame Ideas of the different Size, Figure, Qualities, and Properties, of other Bodies, and annex some Ideas of the Size, Figure, Qualities, and Properties which really belong to one Sort of Bodies,

Bodies, to the Ideas of another Sort of Bodies, and by that Compound of Ideas, frame a new or different Idea of the Body, or by extending or diminishing the Size, Quality, &c, raise an Alteration in the Idea.

By retaining the Ideas of the natural Actions of natural Bodies, and of the Effects those natural Actions have upon these, or other natural Bodies, we frame Ideas of the Actions and Effects of natural Bodies, and foresee how such Bodies will act, and what Effects those Actions will produce.

To know by what Agents, and how the Globes are moved, in what Spheres, and how they move, what Qualities the several Sorts of Matter have, how they have them, is of much Use to us; as the Knowledge of those Motions, Qualities, and Manners, can be made serviceable to Man, in answering the Design of God: It was necessary that he who created and put all these Things in this beautiful Order, should know all the Motions, Actions, and Qualities of Matter. And it is necessary for us to know so much of them, as may enable us to have the Benefits designed from them.

By retaining Ideas of the Actions of our own Minds, we frame Ideas of the Actions

of our own, or other Minds, and annex Actions to Minds, which those Minds have not acted, and view those Ideas, that we may know how those Actions of the Mind would appear to the Mind if they were acted.

By retaining Ideas of Actions of our own Minds, or others, whose Abilities we know, we frame Ideas in proportion to the several Abilities, biased or unbiased Manner of acting; of the Justice or Fitness of those Actions, Circumstances, Time, and the Knowledge we have of them, and the Singleness or Perplexity of the Case considered.

By retaining Ideas of the Actions of our Mind, and the Impressions these Actions leave upon the Mind, of Pleasure or Pain, we frame Ideas what Impressions other Actions will leave upon the Mind. Man, by viewing the Ideas of Actions before they are acted is like God.

Because we know not clearly how Minds naturally act; because we cannot see into the Mind of others, nor know what moves them to this or that Resolution; and because many Minds act unnaturally, and because it requires an infinite Capacity to view and compare so many Ideas, as are at once concerned in the Minds of several Persons,

Persons, whose Actions depend one upon another, we have little Fore-knowledge of the Actions of other Mens Mind, and no certain Foreknowledge of our own.

Brutes have as much Knowledge imprinted as serves for their Conduct. Man has Instincts to pursue, and Reason to direct those Pursuits as much as serves for his Conduct.

All Brute Creatures are forced to pursue their Instincts, each as they come, and when they come, and seldom err. Men are left at their Discretion, whether they will execute, or defer any of them, as they think fit; and as long as they think fit; and whether they will pursue them regularly or not; and those which they pursue regularly, where outward Force, cannot, or does not, compel, are accounted Virtues. If they were forced by Instinct, or compelled by Force, they would be no Virtues.

Our Senses and Intellects are adapted to perceive the Objects, which are of Use to us to perceive, and each limited to the Degree, in which we shall perceive each. Those which are nearest, or concern us most, clearest; and those which are at greater Distance, or concern us less, with less Degrees of Clearness in Proportion.

We

We cannot perceive, or find any Pleasure, to the Body or Mind, but only in those Things which God designed should afford us Pleasure. And those are only found in pursuing, or doing something which was intended to be our Duty: We may amuse ourselves in seeking Pleasure some other Way; and that seeking for awhile may be a Sort of Diversion; but at the End of the Search, we shall find no Pleasure in them.

All the Pleasures of the Senses arise from the Frame of the Organs of Sensation, whereby they are adapted to the Objects intended to please them, and by the Proportion of the Objects, or Agents to the Parts, and beyond that Proportion, they are disagreeable one to another, as Fire in Degree of Warmness agreeable, in Degree of Heat disagreeable; so of any of the Senses. Those strong Smells, which offend one, may be pleasant to another, only because the Covers of the Arteries in his Nose are thicker, and the volatile Corpuscles, which wounded and offended those of the other, may tickle his, and afford an agreeable and pleasant Sensation: And a natural Instinct, which is called the *Law in our Members*— urges us to enjoy those Pleasures, each in due Proportion

sion to the Objects, and to one another ; and each of those Pleasures are adapted to induce us to pursue some natural Duty, and proportioned greater or less, as the Duties they induce us to pursue, are in themselves, or as the Advantages are which arise from doing them to ourselves, or Society ; and each is heightened, or exceeds the rest, at the Time when that Duty is to be performed. And the Pain or Uneasiness of the Senses arises from the Frame, or Proportion of the Objects which were designed to displease.

The Pleasures of the Mind arise from the Bent of the Faculties and Inclinations of the Agent which perceives, whereby they are adapted to the Ideas or Objects intended to please it ; and from the Proportion of the Ideas, or Objects, to the Capacity of the Agent which perceives, and beyond that Proportion, though there seems to be a Desire of perceiving, there can be no Perception, and consequently no Pleasure in Perception. God could have given Man a larger Capacity of Mind, or Powers of comprehending Things now incomprehensible ; but that was not found fit in this State, and trying to attain Knowledge, not revealed, or not to be comprehended, is endeavouring to break through the

the Limits God has appointed : For if our Minds could comprehend infinite Objects, they would neglect finite ones, and not attend the Government of our Passions to perform our Duties here. And the Inclinations, or a natural Instinct, which is called — *the Law written in our Mind* — urges us to enjoy those Pleasures, each in Proportion to those Objects, and one to another ; and each of those Pleasures of the Mind are adapted to induce us to pursue some natural Duty, and are proportioned, greater or less, as the Duties they induce us to pursue, are in themselves, or as the Advantages are, which arise from doing them, to ourselves, our Relations, or Society ; and the Pain or Uneasiness of the Mind, arises from the Nature of the Ideas of those Objects of the Mind, or Actions, which were intended to displease, or render the Mind uneasy ; and this Power or Faculty, imprinted in the Mind, we call Conscience ; so that any Thought, Study, or Employment of Mind, in contemplating the Goodness of God for Self-Preservation, for the Benefit of Relations, or the Good of Society, shall afford Pleasure and Satisfaction to the Mind ; and any of those to any other End, or out of our natural Duties, shall perplex,

perplex, draw the Mind into a Labyrinth; make it uneasy, and repent, nay, fix lasting Impressions upon the Mind, so that upon recollecting, or remembring the Ideas of those Actions, the Pleasure or Un-easiness of the Mind shall be renewed; which we call Actions of the Conscience.

The Duration of each of the several Pleasures of Sense, and of the Mind, are adapted or proportioned to their several Ends, to incite us to pursue each of our several natural Duties, in their proper Turns, and for their proper Times; and neither our Bodies, nor our Minds, are capable of enjoying, or perceiving more than one Pleasure at once, nor any Pleasure, either of Sense, or Thought, long: That one should not pursue several Duties at once, or dwell too long on the Pursuit of any one; our Bodies in a short Time tire with Action, and require Refreshment, and Rest, to enforce the Duty of Self-Preservation, without which we cannot perform any other Duty, nor subsist; and our Minds in a short Time tire with the Pursuit of any one Thought or Study, and is refreshed by Change, and capable of receiving new Pleasure in new Ideas, that every Duty might have it's Share of
the

the Actions of Body and Mind ; and if we pursue any Pleasure of either, as long as it is conducive to the performing of the proper Duty it was implanted for, it yields the Mind Pleasure, if longer Uneasiness, both at the Time, and afterwards, which we likewise call Actions of the Conscience.

Since our first Parents had every Thing provided necessary for them, and sufficient Knowledge how to use those Things, and govern themselves, and Laws to restrain them. And since God made himself sufficiently known to them, by creating them, providing for them, and by Communication with them. And since they had all the Pleasures of Sense, and of the Mind, which was necessary in their State ; and since, while they did their Duty, and were innocent, they could have no Doubt of the divine Favour, or of his Power to make them happy : What could tempt them to forfeit their Dependance upon him, by breaking his Commandment : Truly nothing but an Eagerness to pass over their State of Trial, and immediately to become like Gods, and nothing less could have prevailed with them. And since their Off-spring had every thing necessary, ready provided, to be procured at first

first by the Care of their Parents, afterwards by their own Labour and Care. Since they have Instincts to drive them to do their natural Duties, and Pleasures annexed to them both, in the Pursuit and Execution : Since they have the Instruction of Parents, and Leisure to acquire Knowledge, by Experience, Instruction, and Example : Since they have Powers to view their Motions and Actions, and the Motions and Actions of all other Bodies and Things, in Idea, how they will appear before we move or perform them : Since we are guarded by Instructions and Laws from above to restrain us, Promises to incite us, Pleasure of Mind in doing our Duties, and Remorse and Uneasiness of Mind in doing otherwise ; and many other Opportunities of publick Instruction, publick Laws, Executions, Rewards, natural Rewards, natural Punishments, &c. whence arise the Depravations in our Nature, that all those Fences will not keep us in ; and that we make use of all our Skill, and use all the natural Pleasures and Incitements to our Duties to contrary Ends.

A Being which is infinitely perfect, needs nothing else, nor depends upon nothing else for Happiness ; created Beings must

must be subordinate, want something of Perfection, depend upon the Being which created them, and must have these Things which were intended to make them easy or happy, or want Ease or Happiness. Man was not created perfect; nor in the Possession of the State of Happiness intended for him; but was to acquire that State by Obedience, was to live in a State of Probation, and Dependance for a Time, and the Pleasures of Sense, or Mind, were not sufficient, nor durable, to satisfy him here, nor nothing was intended to satisfy his Mind here, nor he had nothing to depend upon for that Satisfaction hereafter, but an Assurance of the divine Favour. His Mind was adapted to this State, and that Assurance was made sufficient to please his Mind in this State: But Man, by his Disobedience, lost his Innocence, and therewith his Assurance of the divine Favour; and Consciousness of that, introduced Doubtfulness and Uncertainty of that Favour here, and of being filled with it hereafter; and upon the Soul's wanting it's proper Subsistence, there arose a hungering or thirsting in the Soul, for something to subsist and satisfy it; and that was further increased by a Want of Sufficiency in the Pleasures here, to fill the Capacities of

of the Soul now ; and by a Want of Duration in those Pleasures, to make the Soul depend upon them hereafter. This I humbly think was the only Change in the Souls of the first Parents, and of their Race : And that which made their Souls uneasy, and sollicitous to seek, find, and secure Satisfaction or Pleasure some other Way, and upon Trial of any, and finding them neither sufficient, nor durable, continually spurs them on to seek and try new ones, and makes the whole Race so restless and irregular. This first appeared in *Adam* and *Eve* hiding themselves, and afterwards in *Cain's* being dejected, and killing his Brother.

God, who knew Man could not subsist without a Dependance upon him, in his great Mercy, upon passing Judgment, made a Promise that this Loss should be repaired ; and by several Actions suited to the Senses and Capacity of the Mind, transmitted in Scripture to us, such as that Promise, his Conference with *Cain*; his Translation of *Enoch*; his Conferences with *Noah* and *Abraham*; his Appearance to him, to the *Israelites*, &c. by the Sacrifices before the Law : By the Law which, the Apostle says, was added, because of Transgression in it's several Parts, by Sacrifices

to quiet the Minds of Men, and make them believe God would be atoned for their Trespasses, by that, the Sacrifices, &c. typified, to quiet and cure their raging Pains, by looking not only upon the brazen Serpent, but beyond it, by the Worship and ceremonial Parts of the Law, the Washings, Cleanings, &c. to persuade them that the Obedience and Cleansing, they typified, would be Means to qualify them to procure the divine Favour and Happiness; and the Incarnation of Christ, his Instruction and Miracles, and at last his Sacrifice, Resurrection, Ascension, the Descent of the Holy Ghost, and Powers conferred upon his Followers, were sensible Demonstrations to those who saw them, that that Atonement was made, and that God's Favours were dispensed to Men, and that he was put into a Capacity of procuring greater Degrees of it.— And as Faith was an Assurance to those who saw these Actions arising from an Evidence of Things seen, of the Consequences or Things, which were not seen, by comparing the Ideas of Facts which were seen, and of their known Consequences, with Ideas of like Facts, and drawing Conclusions, that like Consequences will follow like Facts, as if
that

that Power could raise one Man from the Dead, the same Power could raise another from the Dead, &c. so Faith has been since, and is, to these who have not seen those Facts an Assurance that Facts, which could not for ever after admit of ocular Demonstration, were committed, and have been transmitted to Posterity, by Relation, Records, Evidences, and Circumstances, arising from the Sufficiency, or Conviction of that Evidence, &c. by comparing Ideas of the Evidence of those Facts, with Ideas of the Evidence of the Facts, which have since been acted, and the Ideas of the Certainty of those Facts, with the Ideas of the Certainty of the Facts which have been proved since upon such Evidence. — And by comparing Ideas of Facts, and their known Consequences, with Ideas of like Facts, and drawing Conclusions, as those did who saw the Facts, viz. that our Trespasses were atoned for, and that we are restored to the divine Favour here, and shall enjoy it hereafter, makes us comparatively despise all other Knowledge, and all other Pleasures, and all Afflictions, and pursue the Methods of obtaining further Degrees of his Favour, of which St Paul spoke feelingly. There seems to me to have

been no supernatural Changes in the Soul, either at the Fall, or at our Renovation, and becoming new Creatures. The Change of Mind aforesaid, at the Fall, was sufficient to put all in Disorder, and this Change of Mind to a Belief that they were, or we are, restored to a Dependance on God's Favour here, and to the Means of enjoying it hereafter, would put all right, restore the Image of God in Man, make Man pursue his Instincts, naturally follow the Directions of a perfect Mind, or obey God willingly, reason justly, pursue or seek for, or depend upon Happiness where it is, pursue the Pleasures implanted in Things below, for the Ends they were designed for, as Incitements to the Actions, which are our Duties, and not seek for, or expect to find, or place his Happiness in any of them, or in Knowledge, or any other Amusement; to pursue the parental and relative Duties to the same End, as God does in creating, sustaining, and loving the Race of Men his Off-spring, viz. to make them happy, to receive that State of Mind, as little Children who depend upon the Affections of their Parents, and seek for no Support any other way.

It

It seems from the Nature of Things, that a Person that believes God, Infinitely Great, Good, and Just, and that he design'd to make Man happy, and that Man forfeited God's Favour by his own Fault, and that no other Being but God's only Son, could redeem Mankind, and that he has redeem'd Mankind, and put him on new Conditions, and that he himself has perform'd the Conditions of Admission, repented, believes, &c: and is in his Favour, or reconciled to him, and is assured to be made happy by him, he must of Necessity love him and all his Offspring; and when a Man is so perswaded, the Evidence will appear in Degrees proportionable to the Degrees of his Afflurance, and to the Degrees of Sins pardon'd, &c. 'Tis natural to return Love for Love, and in Proportion, as soon as we are assur'd that God has redeem'd, we must love him, &c. in Proportion to the Degrees of Sin and Misery, he has redeem'd us from. At first, when *Adam* preserv'd his Integrity, he loved God for the Benefit of putting him into that State, and giving him Capacities to perform the Conditions, and if there had been other People created, he would have loved them also; but no false Opinion, that we

live a good moral Life, of being able of ourselves to do our Duty ; of our own Merit to spare, of being of the Elect, of having the Spirit, can work this Change in the Mind of Man, nor the Effects never appear'd in any but true Believers : The Devil, nor any Being, never pretended to mimick this, and as want of Assurance, or Dependance, makes those in their wishes Atheists, who pretend to be so, their Minds cannot be easy, because they have nothing to depend upon, nor even that which they wish for, which is next to Hell itself.

The Knowledge of every Duty or Part in Revealed Religion, necessary to be believed, and perform'd by us, are adapted to be convey'd to the Senses, and by them to the Mind, and to be comprehended by the Abilities of our Minds. Before the Mosaic Dispensation, there was the Sacrifices, and the Sacrament of Circumcision, the Sacrament of the Passover : under the Law, the Sacrifices, Washings, &c. All that was requir'd of them, was to perform the Institutions and Commandments, and depend upon God's Favour ; had they reasoned justly, as Believers in general did before, and as St Paul did afterwards, could the Blood of Bulls and Goats atone

tone for Sin, and therefore neglected the Means appointed, their Knowledge would have been of no great Service to them; nay, if they could have offered Minds rightly qualified by Faith, as some of them did, and had not perform'd the Law, if that had been possible, it could not have been accepted, no more than it will be now; — in the Christian Dispensation to know, that God exists, that the first Person in the Trinity has accepted Christ's Sacrifice, for an Atonement for our Sins. That the second Person incarnate has atoned for our Sins, that the third Person assists our Minds to believe that God was able to do those Things, that he has done them, that he has given ocular Demonstration in doing them, is necessary; but 'tis of no use to us to know, and have full Ideas of him, to believe that the Acts of Admission and Commemoration to be perform'd, be the Means he has appointed, will afford the Advantages he has promis'd: No matter to us to know how, he can hear our Prayers, and assist us; 'tis of no use to us to know how 'tis necessary, that he who saved us, and is just, should know the Manner how, and that the Manner is just; 'tis enough to us to be saved, without knowing the Manner how,

unless we would be like God, and know every thing here, without being content to know those Things which are necessary, in doing our Duties here, and staying to know those things which are not till hereafter.

Because Men who pretend they believe, make Conscience their Director in every thing, and conclude, that if they keep it quiet all is right, 'tis necessary to know what Conscience is.

Our Consciences seem to be Instincts plac'd in us; which are adapted to be pleas'd at doing any of our Duties in Natural Religion, and uneasy at neglecting or acting contrary to any of them; so that Conscience, in natural Duties, will seldom or never err. Revelation is a necessary Information of the Will of the Creator, which was not imprinted originally in Man, but adapted to his Change in State, and we are at our Perils to know, and believe, and observe, what is reveal'd by the Means of the Word and Ministry, and neither Sincerity, nor any natural Virtue, can supply the Place of those Duties required by Revelation; nay, though we perform all the natural Duties, we cannot recover our Forfeiture and be saved, without performing the revealed ones; nay, though

though we perform all the revealed ones also, as well publick as private, except that native Instinct, we call Humanity, be extended to that universal Affection to all the Offspring of God, which we call Charity, in Gratitude, or Return for our Redemption, we cannot be saved. And as there are natural Instincts in Man, to obey God, his Father, Prince, &c. when any of their Wills is revealed, if we obey it as we think it is, or as we understand it, our Minds are easy, and when we think we do not, or do not understand it, uneasy ; this is all Conscience has to do in Revealed Religion ; if Knowledge of things revealed had been imprinted in Man, they needed not have been revealed ; nay, indeed could not have been revealed, because they were known before ; and except we make Conscience something equal to God, without reasonable Instruction or Chance, as to the Manner, Form, or Mysteries in Revealed Religion, it must often, or always err. Conscience can as soon direct a Man to observe the Will of his Father, or the Decrees of a Prince, which he has not seen, or does not understand, or to the Observation of the *Mosaic* Law, without understanding the Precepts, or being Instructed by the Priests ; nay, that

that the Knowledge of it was in Man, before it was revealed, as it can direct an illiterate, uninstructed Man, to observe the Decrees or Revelations of God, in his new Covenant, or in the mysterious, sacramental, or ceremonial Part thereof which he does not understand, nor has no Instincts to direct him, nor no Means to come at the Knowledge of, but the Letter of the Revelation, the Instruction of the Ministry, from whence arises, the Necessity of the sacred Orders, the Use of his own Reason or Endeavours, and the common Assistance of the Divine Spirit, and which none of the Angels in Heaven, nor no Being less than omniscient can know, but by Instruction and Information. As some Men have studied Books, till they have neglected the natural State of Things, others have confounded themselves with Notions, that Revealed Religion thwarts Natural Religion, and the Instincts to our Duties in it; others with Notions of Abilities, which were never design'd for Man in this World, till they have left themselves no other Rules but their own Fancies, under the undetermin'd Name of Conscience, which always was, and always will be the same in every Man.

There

There seems, by the Nature of Things, not only to be a Necessity for Death, but for changing the Instincts, and Inclinations, and Faculties, both of Body and Mind, and of proportioning them to new Objects, and of a separation of the regular from the irregular, to Places adapted with Objects, to answer the Ends, to afford Pleasure to the one, and Pain to the other.

Such Instincts as are useful to ourselves, Relations, and Societies, and are called the Law in our Members, I think are annex'd to those Bodies, and must cease with them at Death, because the Soul wants no Supplies, does not procreate, and has no Ties to Relations, and can only be separated from the Body; and since the Duties of Self-preservation, Growth, Procreation, and all the rest, such as conjugal, paternal, filial, fraternal, servial, and political, will be useless and cease, because our new Bodies will need no Preservation nor Supply, nor will have no relative Duties to perform: For if they were annexed to the Soul, and were to continue with it afterwards, they would be useless, and certainly we shall have no Instincts hereafter, but such as that State will afford Satisfaction in the Pursuit of, because Desires

Desires without Objects to satisfy them would make us unhappy ; and since the Relations there will be no other than between God, as our common Father, and all the obedient created Beings, as the Offspring of God as our Brethren, only that Reverence, Gratitude, and Affection to God, and that universal Affection to our Brethren, which we call Charity, which were naturally imprinted in the Soul, and the Renovation of them, or restoring those natural Instincts to us, so often mentioned in Scripture, will be completed, and will remain and afford perpetual Pleasure, in the Exercise of them. What Instincts and Faculties God will be pleas'd to give to our new Bodies, I know not, but I humbly conceive they must be adapted to himself, the Company, Objects, and Employments intended for us ; so that the Pleasures hereafter, (in whatsoever they will consist) must arise by our Faculties, being adapted to take Pleasure in those Objects, which will be in that happy Place, and intended to please them, and as our Faculties hereafter will need no change, to refresh one Part, while another acts, nor Rest, nor Refreshment, they may enjoy as much Pleasure continually by that Change, as we can

can for a Moment now, and greater in proportion as they are enlarg'd, and the Degree of Rewards or Happiness must consist in the Bent and Capacity of the Faculties, or the Abilities or Power of relishing those Pleasures, be they in Contemplation, Conversation, Love, or, &c. and the Objects of those Pleasures, must fit our Capacities, be irresistible Ties to make us persevere infinitely in doing our Duties.

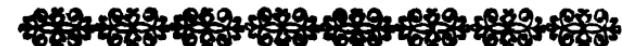
Since Men, who have acquired Knowledge, fancy their Happiness, is in Proportion to the Degrees of their Knowledge here, and will be so hereafter, and either be fixed according to those Proportions, or that it will increase as their Knowledge increases, there; and that each will have the Power, or Abilities of increasing their Knowledge, in Proportion as they have increased it here, to hinder those of inferior Ranks, from coming too near them, or being but the Length of the Life of Man behind them. Of what Use can our imperfect acquired Knowledge of our relative Duties to one another, of the Actions, Customs, or Laws of Princes or Countries, of the Frame, Figures, Qualities, or Uses of natural Creatures, or Things, of the Motions of the Spheres, &c. be, when all those Duties,

Duties, Things, and Uses are ceased to be, or of the Creation, Mosaick Dispensation, of the Prophecies, nay even of the Redemption of Man, by the new Covenant, the Mysteries and Duties contained in it ; since all those Things will be accomplished, and nothing remains except the Pleasure which will arise by looking back ; and seeing how Things were contrived for our Benefit, a Study, which has been little pursued, a Knowledge which we have acquired very little of, or the Pleasure of having overcome Difficulties, and done our Duties, which we neglect so much here. Nay, of what Use will our imperfect Knowledge of God be, when we shall be so happy to see him, and all his Works and Actions in a clear View. --- And since few are entrusted with the Talent or Capacity of acquiring Knowledge ; and since, according to the Situation of Things, few can study and acquire Knowledge, if nothing but acquired Knowledge were of Use hereafter, or that Men were to have Knowledge in the same Degree as that they die with, and Happiness in Proportion ; and that their Knowledge and Happiness were to improve in the same Degree, this would be very hard upon the greatest Part of Mankind ; and if that Opinion

pinion were general, those who have slender Capacities would neglect all other Duties, and run mad with studying; but 'tis more likely that God will capacitate each one for a Share of that Happiness, in Proportion to the Improvement he has made of the Talents delivered to him, and of the Opportunity he has had of employing them to Advantage, or to their proper Uses: And that he, to whom he has given a Talent of Strength and Genius, to this or that Sort of Husbandry, Manufacture, Mechanicks, Courage, or or any Capacity to perform any thing for the Service of himself, Relations, Society, or Mankind, and an Opportunity of employing them, and who has used them well, to the Advantage of himself, Relations, Society, or for the Service of Mankind, the publick Bank, so that he himself is bettered by doing his Duty, or his Relations, Society, or Mankind, are bettered, or have been enabled to do their Duties better, and thereby be fitter for knowing and serving God, and enjoying Happiness hereafter, will be rewarded with equal Qualifications, to enjoy the Pleasures hereafter, whereinsoever they will consist; as he that has had a Talent or a Genius given to understand the Laws of God, of Man, of Nature, or any

any other Science ; and has had like Opportunity to improve it, and has improved it to the same Degree, for bettering himself, Relations, Society, or Mankind, or enabling them to do their Duties better, and so in Proportion to the Weight of the Talent given, and to the different Degrees of Assistance and Opportunity, or Obstruction each of them has had, and the Degrees each of them has improved them to adding the Opportunities, and subtracting the Obstructions, and weighing the Talents, gained, acquired, or improved, by the Weight of the Talents, when such Addition, or Subtraction, has been made, and proportioning the Rewards, or Happiness, not to the Weight of the Talents, but to the Number of Talents improved or gained ; and where the Obstructions has outweighed the Talents given, accepting Endeavours for Actions, or Improvements. If the Assistance and Opportunity of those within the Pale of the Church, and the almost insuperable Obstructions of those born in Paganism live under, be considered, I am afraid, those living within the Church, at their present Rate of living, will not outstrip the others very far.





A

T R E A T I S E
O N
M I N I N G.

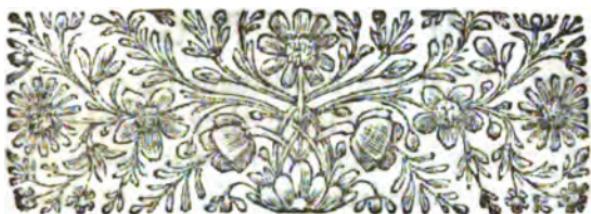
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VOL. XII.

M





M I N I N G.

WE know nothing of the Manner of the Formation of the antediluvian Earth by Revelation, but that it was created without Form, and void; and that there was a great Deep of Water at the Surface; whether the Earth was created in a hollow Sphere, round and smooth on it's Surface, and that Water in a round Sphere about it; or it was created in Corpuscles diffused in that Water, and settled into that Figure, is not material. When the Waters went off into that Void, the Surface had it's Form of Mountains, Vallies, Rivers, and Seas; whether it had that Form before they went off, or they gave it that Form in going off, and so carried off some Parts of the Surface with them into that Void, is not expressed; but there is some natural Evidence which makes me believe the

latter. That the constituent Parts of the Whole were the same they are now, is very likely : That there was Stone and Metals is revealed ; but in what Order they were disposed, whether the Stone was in Strata, or the Metal in Veins, appears not.

Some Time before Noah's Flood, Moses faith, *The Earth also was corrupt before God, and the Earth was filled with Violence, and God looked upon the Earth and beheld it was corrupt ; for all Flesh had corrupted his Way upon the Earth : And God said unto Noah, The End of all Flesh is come before me ; for the Earth is filled with Violence through them, and behold I will destroy them with the Earth.* — It seems as if the Earth was itself corrupt, by being some Way accessory to the Corruption of Men ; and that it was to be reformed for the new Race of Men, whatever Agent it was that God employed, or what Alteration he made first, to raise such great Quantities of Vapours from below, and afterwards the Waters, &c. it prevailed against the Force above, took off that Power of Attraction, which kept Masses of solid Matter together, and let them divide ; and that Power which gravitated them towards the Center, and let or forced them to rise. And it is evident

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to the Eye now, that the solid Parts of it, as deep as we can go, and by Deduction, that the rest, down to the Center, were dissolved, and taken up into the Water which issued out of the Abyss and Seas; and that that Mixture, together with the Remains of animal and vegetable Bodies, was suspended in a Sphere, extending into the Place where the Atmosphere now is, to an immense Height. It is not said, that that Part of the Atmosphere, whose Sphere was thus possessed, went into the Abyss; but there are plain Proofs that it did, and it is strongly imply'd, that it came out when the Waters returned thither.

While all terrestrial Matter was in this State of Solution, and in that Position, or so situated, and that Motion from the Center ceased; by sundry Evidences it appears, Things were so disposed, that the Agents, which produce Winds and Tides, could not act; and that the Water, or Mixture, was very still, and every thing rested near the Level, where the said Motion left it with little or no Regard, to what they call specifick Gravity: And that the Water near the Surface was free from Corpuscles of Stone and Metal, and in a great measure from Salt; and the Power or Force of that Agent, which

they call Attraction in small Bodies, and now Gravitation, towards the Center of this Globe, differed much in it's Operation from what it does now. The fluid Mixture could no more incroach upon, or enter into the Sphere of the Abyss, than it could fly up into the Firmament. The Power of gravitating Bodies in the Fluid towards the Sphere of the Abyss, was very little; and thereby it's Power of attracting one small Body towards another, in all Directions, was much greater than it is now, greatest near the Surface of the Abyss, and less and less, nearer the outer Surface of the Water.

While this Agent acted chiefly by Attraction of small Bodies to each other, the Nodules, and small Masses, according to the Fitness of the Sort of Corpuscles to be attracted and unite, the Figures they were disposed to take, and the Quantity or Proportion of them in each Part of the Fluid were formed; for by the Power of Attraction in that mixed Fluid, one Corpuscle approach'd another, which were each most attractable, and so from a Centre formed, attracted those on each Side, which were most attractable, and repelled those which were less attractable; whereby those which were most attractable in that

that Sphere, were separated from the rest, and formed into Nodules ; and those Sorts which were near equally attractable, were mixed, and formed into smaller Masses. Thence those Nodules we see of Iron-Stone, from the Size of several hundred Weight downward ; Those formed high up, nearly round ; those lower down flatter on their under Sides ; those of Flint, from half a Hundred Weight downward, the Sides approaching round, but very irregular, some Sorts into the Figures of Stems of Trees, Shrubs, Plants, &c. by entering into their Pores and Interstices, some into the Figures of the Hollows, in or between Shells, some at large, some at very small Apertures, some about a Shell, Leaf, or, &c. some other Sorts into Knots, or Grains, from half an Ounce downward ; some into Plates, some into Threads, some into Flakes like Snow, and some into Powder.

As soon as the Masses near the Surface of the Abyss were formed, so large as that Attraction worked strongly upon them conjointly with a very small Degree of Gravitation, they came nearer together, the lowest rising, and those next above subsiding very slowly, while the Parts less attractive, and the Water receded each Way, and thereby was formed the first

Stratum, or a spherical Arch, or Cage, about the Abyss, or Void. As soon as that Stratum was formed, the Nodules and Masses, which were but a little Height above it, would be moved with a little more Power towards it, and meet with less Resistance from the Water so freed, and, if nothing intervened, thickened the Stratum: If other Matter intervened; formed a second Stratum; as more Strata subsided, the Nodules and Masses would successively begin in their Turns to subside very slowly. The Nodules taking their outer Coats, and the Masses some new Matter out of the Water, through which they passed; and the Power of Gravitation would increase, and rise towards the Surface by very slow Steps; and as far as I can observe, or deduce, in some Places sometimes diminished, or ceased to act; and was not very great, when the Strata were all formed, I think nearly smooth, or equi-distant from the Centre, and it is likely a Sediment of Earth, or vegetable Matter over them, and with the Water in a Sphere about the Crust or Shell.

These Nodules and Masses subsided in Direction, as Bodies fall now, according to their Centres of Gravity and Opposition of the Fluid; the round ones any Way, but

but are found in some Strata a little flattened; the angular with their Points foremost; and the plated, with their Edges foremost; and in some Places, where there sunk a great Quantity together, stand so or inflected in the Strata; the Metal, all except Iron, in small Corpuscles, at too great Distance to unite, the Water, rising still upward, except what remained in the Interstices of the Grains, Sand, &c. and the Sea Salt mostly with it, upwards, or with the Water that remained, except that lodged in Rock Salt, which I have not had an Opportunity to view. Whether the Salts united with the several Sorts of Metals be Sea Salt, and receives it different Appearances from it's Union with Corpuscles of different Sorts of Metals or Minerals; or whether they are distinct Species of Salt, adapted to adhere to different Sorts of Corpuscles, I am not certain.

If the primary Corpuscles of Stone, had not, by Attraction, been thus formed into Masses of various Mixtures, Figures, and Sizes, the then Power of Gravity could hardly have forced them to subside; and if it had had the same Force that it has now, and had made them subside, it would have united them all in one, there would have been no Separation of Species
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but where they were distinct in the Water, and so close that the Metal could not have issued out of them, and they would have been so hard, that it would have been impossible to break, split, cut, or make them fit for the several Uses we employ them in.

It has been an insuperable Objection against the Strata being formed by Sediments out of Water: That Nodules of Iron-Stone are found often above Strata of Coal; those of Flint, above Strata of Chalk; and Strata of great specifick Gravity are found above those which have less. If Gravity had commenced to work at once from the Surface of the Abyss to the Surface of the Water, all would have sunk in Confusion: But as the Power of Attraction was strongest at the Bottom, and the first Stratum next, the Surface of the Abyss was rather formed by Attraction than Gravity; and when the first Stratum was formed, a very small Degree of Gravity commenced, and reached a little higher; it only had Power over those Masses within it's Reach at once, and so as new Strata settled higher Step by Step. When Gravity was so small, and the Water full of Corpuscles of Stone, Metal, Salt, &c. none of them could subside till they were formed

formed into Masses, where they were all of a Sort within each Sphere of Attraction, or Depth of Water, and all in Masses of the same Size : When the Sphere of Gravitation reached them, they would all fall in Succession, the nearest first, and those highest up last. Where there was near an equal Mixture of several Sorts of Corpuscles in one of those Spheres of Water, and one Sort was more adapted to be attracted and unite into Masses, or Plates, and were adapted to be most gravitated they would settle first, and so in order. Where there was a greater Proportion of one sort than of another, which were equally adapted to be attracted and gravitated, that Sort of which there was the greatest Proportion would be attracted into the largest Masses first, and settle first, and so in Order with these Differences in the Formation of a few of the lowest Strata among those Masses, of nearly the same specifick Gravity, that the smaller, near the Stratum, would sink as soon as the larger would do at a greater Distance ; but as more Strata settled, and the Sphere of clear Water grew deeper, that Difference would be inconsiderable ; and that, when one Sort subsided, that Sphere of Water became thinner, and the Remainder would both attract and unite quicker,

quicker, and subside in lesser Masses : And that, as the Number of Strata increased, and Gravity increased a little, the Depth of the Sphere of Water those Strata had freed, and the Distance of the next Masses to be attracted was increased, so that the Power it had to move those which settled in the second or third Stratum, when Gravity was least, was near as great as that it had upon those at greater Distance, when Gravity was somewhat greater : And that there were often some few Corpuscles of the same Sort of the highest Stratum, which were not united, large enough to subside, which were borne down by the next succeeding Stratum, and are formed in the under Side of it ; and where there were any Masses which differed vastly in specifick Gravity, such as Iron-Stone, common Stone, Slate, and Chiver, Chalk, Clay, Coal, Bitutmen, Sulphur, &c. as the heavier sunk, the lighter would emerge to near the Top of that Sphere of Gravitation, till the rest below were all settled, and the Water gave much less Resistance, or they became so nearly contiguous, to sink, or be borne down by those next above, and so became more uniform, purer, or freer from Mixture than the Strata, whose Masses were nearly of the

the same specifick Gravity, and the Plants and Leaves interspersed in the Mixture, by this means rose with the Coal, Slate, &c. and are now found preserved in them; and the Layers of several of the lightest Sorts of Shells, &c. were thus collected, each in each Sphere of Attraction, and the last at the Surface. No Experiments which can be made here now, can prove or illustrate these Actions, because Gravity works stronglier upon small Masses than Attraction, and keeps them from moving to one another, horizontally uniting, and becoming solid, except in Fire, where a small Proportion of Corpuscles of any Sort of Metal, amongst those of other Sorts of Matter, in proper Fusion, always are collected into a Mass in the Figure of a Nodule. If the Fusion be not regular, into several such; there are some small Instances of Attraction between Corpuscles of Metal in Solution by Spirits of Salt, so small, that Gravity cannot force them down; and those of other Metals, or Salts, put in, but a small Augmentation gives Gravity hold of them: That of large Hail-stones being formed in the Air at great Distance from the Earth, where Attraction is now much greater, and Gravity less than near the Earth, comes nearest.

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If Attraction had been of the same Force, in all Depths of the Water at once, and if Gravity had reach'd from the Bottom to the Surface at once, and as strong as 'tis now, the mix'd Corpuscles, could not have been thus sorted into Strata of different Thickness, Constitutions, and Solidities, nor have been in the perpendicular Orders of Succession they are found, and would not have answer'd the Uses nature makes of them, nor those we make of them.

If the Corpuscles of Stone, had reach'd quite up to the Surface of the Water, and Attraction had been as strong there, as it was a little lower down, the Pores of all the Oaks, Firrs, &c. we find in the Mottes, would have been saturated with Stone, Salt, &c. and all the Plants, Seeds, &c. which replanted the Earth, would have been so fill'd with Stone and Salt, and all the Fish and Spawn would have been destroy'd.

The several Parts of the Water, in each Sphere horizontally, containing different Sorts of Corpuscles, and each Part of these Strata, or Courses of Stone, being form'd out of the Corpuscles, which subsided in Masses, out of that Part of the Sphere of Water, which was at the Time

Time of its Formation, next over it, each of those several Parts of the Spheres of Stone at the same Depths, are of various Species, of various Mixtures of different Textures, Solidity, Hardness, &c. and of various Figures and Dimensions in Breadth and Thickness; the Edges of each Part tallying with the Edges of it's opposite horizontally, and sometimes one, sometimes more, composing the Thickness of those other Parts, which bound it horizontally

In those Parts of Strata, where the Corpuscles were mostly of one Sort, and freest from Mixtures of those of Chiver, Clay, Coal, or other Sorts of soft Matter; the Strata are each of great Thickness, where there was Clay, or other such soft Matter, and ever so thin a Course or Seam of it subsided, it caus'd a Division, and a new Stratum commenc'd upon it. Where all the Masses compos'd of one Sort of Corpuscles subsided together, they made a thick or thin Stratum, generally there is a Seam or Division, between that and the next Stratum. The thickest Strata are generally found deepest, and the thinner nearer the Surface, but in some Places, especially where there are Seams of Slate, or Coal, we find several Successions of Strata, from thin downward, to thick, one

one below another, each Succession divided by a thick Seam, of Chiver, Clay, or Coal.

The Edges of the Parts of Strata, of several Sorts of Stone, in some Places where they are thick, meet one against another in Lines, nearly perpendicular and streight : If the Masses which compose one thick Part of a Stratum, settled alone, as the Space in the outer Circumference of the Sphere of Water, was broader than that each Part of the Stratum would, or could settle into, and as the Masses increas'd in Size, and the whole by sinking approach'd nearer to one another perpendicularly, they also by Attraction, approach'd nearer to one another, and each towards the middle horizontally, and so kept its Edges nearly streight.

And if two adjoining Parts of Strata or more settled together, or at the same Time, their Edges push'd against one another, and partly by the Motion they were in by Attraction, each to the middle of each, and partly by their Edges jumping against one another, they would be form'd each narrower as they subsided, and their Edges nearly streight. In other Places, mostly where the Parts of the Strata are thin, the Corpuscles, or Masses near

near the Edges are mix'd, or did not unite well with each other; but form'd lax or soft Parts between the Edges of these Parts of the Strata, as these soft Parts did not happen one over another, but were overlaid alternately by harder Parts, they did not incommode or weaken the arch'd Case.

When the spherical Arch, compos'd of those spherical Strata, each compos'd of infinite Numbers of Parts, each Part commonly call'd a Stratum, was form'd, and the Water was upon them, and the Abyss I think full only of Atmosphere, and Gravitation very small, the Water which sunk with, and was intermix'd in the Interstices, in, and between, the Masses of Stone, the Force of that Agent, by the then Laws, or proportions of Attraction and Gravity, began to hunt or ferret it out of the Strata, in a horizontal Direction strongly, and in a perpendicular Direction weakly, and the same Force made the Strata contract and form Fissures, or Rifts, or Veins transverse, mostly near streight and perpendicular, some inclining, and some crook'd, and here running mostly near E. and W. and smaller cracks out of their Sides, commencing at the Surface of the Abyss; and successively upward; the large Fissures chiefly in the lower Strata,

which were of some considerable Thickness, and split into several smaller Fissures in the thinner Strata, above or near the Surface, and so where there are several Successions of thicker and thinner, the Bottoms of the Fissures, in a new Succession of Strata, generally commencing some Distance horizontally, aside from the Top of that next below, and the Bottoms of the smaller Fissures in the thinner Strata, frequently commencing at some horizontal Distance, aside from the Top of the Vein.

In those Strata where there were Corpuscles of Metals, Minerals, or Spar, they, by the Power aforesaid, iss'd with the Water which sunk with the Masses of Stone, out at the new form'd Edges of the Strata, the Sides of the Vein, and smaller Strings into the perpendicular Veins or Fissures, the largest or heaviest Species first, and so in digression till the final left last ; the Water out of the first into the Abyss, from those above downward through Swallows, from one Fissure to another towards the Abyss ; and the Corpuscles were first form'd into Grains, Plates, &c. and afterwards were detach'd from the Water, by the then great Force of Attraction, and Weakness of Gravitation,

tion, and form'd into Ribs, or bodies of Ore, or Spar in the Veins, smaller Strings, &c. some near pure, but mostly mix'd. As the Water or mineral Corpuseles issu'd, the Stone contracted more and more, and the perpendicular Fissures grew wider and wider, sometimes by Starts, and these form'd more Ribs, or greater, or more Masses of mineral Matter, and lastly, Shoots of Crystal, Spar, &c. There were other Receptacles for Ore, form'd at the same Time, by the same Cause; but in other Directions and Figures, and fill'd after the same Manner, as Bellies, Pipes, Floats, &c.

Though after the first Stratum was form'd; Attraction cartied the Masses down in the same Direction, as Bodies move by Gravity now, and that Power grew stronger and stronger, till all the Strata were form'd, yet when the Strata began to crack at the inner Surface; things were acted upon (tho' by the very same Rules) in a seemingly contrary Manner. The Parts of the Strata were attracted edge way; the Ore, Spar, &c. which came out with the Water, mov'd sideways to the Edges of the crack'd Strata, the Water which was forc'd out, and the least liable to be attracted, stood in those Parts of

the Fissures, Bellies, &c. which were not fill'd with Ore, Spar, &c. and only mov'd into the Abyfs, as it would rise out of such an open Vein, to the upper Surface now. So by the Laws of Attraction, then in Force, the Grains, &c. of Metal mov'd in Lines, little declining from horizontal to each Side, as such Bodies settle towards the Center now: Where it was near pure or mix'd with hard Matter, it always adher'd in Ribs to the hardest Side; where the Sides were near equally hard, part to each Side; where soft Matter interpos'd, it form'd in Lumps greater or less, in Proportion to the Quantity of Metal, and that of soft Matter. If the Power of Gravity, had taken Place of the Power of Attraction, where the Water had Passage downward, near the Bottom of the Vein, most of the Corpuscles of Ore would have gone with it, and some small Quantity of the Spar, would have been form'd into Stalactitæ. If the Water had stood, and gone off near the Tops of the Veins, the greatest Quantity of the Ore would have been form'd at the Bottoms of the Veins, and they would have been fill'd upward, the heaviest which was there at once lowest, and the lightest next, and so as new Supplies came in successively, and as the Veins

Veins widened successively, and there could have been no Loughs or hollows near the Bottom of the Veins, nor in the Ribs or Masses of Ore.

After most of the Water was driven out, or the Masses in the Strata of Stone, were come so near together, that no more Ore issu'd out of them; in some Places the Strata contracted in another Direction, from N. to S. and intersected the Strata and metallick Fissures (of which those which stand near perpendicular, are call'd Veins, and those which are inclin'd much, are call'd Loads) at right Angles, and at some of them one Side of the Stratum, and one End of the metallick Vein or Load sunk down when it broke, (those I have seen, some a few Feet, and some several Fathoms) those of this Sort, which stand near perpendicular, they call Cross-Bars, those which incline much, they call Course-Bars, they never or seldom contain any Metal, the Cross-Bars are fill'd with Spar, which continues entire between the Ends of the metallick Fissures; the Course-Bars, are fill'd with white, or yellow Clay, like Soap.

Afterwards the Parts of the Strata between Veins, Loads, and Bars, contracted and crack'd in all Directions, and

divided the Strata into lesser Fragments or Plates, according to the several Species, and Contextures of the Strata, some Sorts into very large ones, some into very small ones, some in straight Lines, so that the Fragments are easily separated from one another, and some in crook'd Lines, so that they are entangled with, or lock'd into one another, and not easily separated. The Workmen in Quarries, call a Side of a large perpendicular Crack, a Breast; the Side of a little Crack facing them, a Face, and the Side from them, a Back. Those Cracks in Marble, and Stones which abound with Spar, are fill'd with Spar in all Directions, frequently variously tinctured, and the Spar, or what issu'd out of the Edges of these Cracks, in some Parts, and what the Water carried in other Parts, has varied the Colour of those Edges from the rest of the Stone, which gives the several Colours, to the several Parts of those Stones: Through some of these Cracks, the Clay, &c, enter'd into the Veins which were not full then, or widen'd after these Cracks were made. Some Cracks are fill'd with Clay, but most stand open to this Day.

If these Cracks had not been made, and left open, all the Force, and Art of Man, with
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the help of Gun-powder, could not have raised Stone out of Quarries, sufficient for our Uses, nor with smooth Sides and Faces, fit for our Uses; nor could the Motion of Air for Winds, of Water for Springs, and Rain, and other the most important Actions in Nature, have gone on without them; and if the Agent which exerts that Force, which makes a part of the Shell quake, had not had vent, and the Parts could have bended by those Cracks, wherever that Force had been exerted, it must have blown up the Part.

The laxer Strata, such as Chalk, Chiver, Coal, &c. contracted into Fissures, and the finest Matter issu'd into them; and crack'd in the Succession, and Order aforesaid.

Some of the thin Strata of Iron Stone, by it's strong Disposition to be attracted, contracted and crack'd into regular Figures of equal Sizes.

The Nodules of several Sorts also contracted, split, and crack'd according to their several Kinds; some of the Iron kind have been attracted so regularly, as to split very large ones into small Cubes of equal Size, and form Veins with regular Ribs of Spar, between the Sides of

them in Epitome. The Cracks in other Sorts, are mostly irregular, some fill'd, some open, and some partly fill'd with crystalline Shoets.

That these Cracks or Veins, as well with Ribs of Spar, Threads of Ore, &c. in them, as empty, which have all the Accidents of Veins in Epitome, as the Ludus Helmontii, Marble and Stones which have Shells, Plants, or other Bodies lodg'd in them, were thus form'd, admits of ocular Demonstration; because the Shells, Plants, and Bodies in them, divided by those Cracks, remain part in one Side of the Stone, part in the other, and when put together, tally exactly, and make up each Shell, Plant, &c.

The Ores, Minerals, and Spars in the Veins also contracted, and crack'd into several Sorts of Figures, and the pure Corpuscles of Gold, Silver, and Copper, which had issu'd out of the Sides, together with the Corpuscles of Spar, &c. and were interspersed among them, were ferreted out of the Masses of Ore, into those Cracks, and form'd there in thin Plates of native malleable Metal, the meaner Sorts with the finest Matter, but seldom malleable.

That

That these Cracks in the Ore, Spar, &c. and the Threads of finer Matter or Plates of Metal in them were thus form'd, admits also of Demonstration, because the finer Spar or Crystal, which is on the Outside of the Ore or Spar, and last form'd of any Part of the Ribs, and shot into various regular Figures, are crack'd through, and those Threads and Plates divide their Parts, which compose those Figures, and which could not be form'd at different times.

Gold is found in Ore or Spar, which tho' I have never seen in the Veins, I am sure were form'd there; in some Ores, only in Grains, almost invisibly interspers'd; in some Places in the Spaces between the Sides of the Ore, and the Sides of the Vein; in most Places in Cracks in the Ore or Spar, form'd into Threads or Plates, those against the Sides of the Veins, in some Places adhering, those in the Cracks between the Masses of Ore or Spar, in independent Plates.

Silver is found in the Veins, in small quantity, invisible, intermix'd in Ores of Lead, &c. but where there is plenty, 'tis found form'd into thin Plates pure, interspers'd in Cracks, in Masses of Ore or Spar,

Spar, and some Parts variously and beautifully figur'd.

Copper is found in Veins, mostly in Ribs of Ore, of various Colours, as purple, blue, green, Gold-colour, Silver-colour, grey, brown, and mix'd, seldom figur'd, mostly pretty hard, and generally mix'd with Sulphur, or vitriolick Salts, sometimes, but rarely, found in Plates pure, form'd, in Cracks of the Ore.

Tin is found mostly in Grains like Glais; of a dark Colour, in Mats; when broke into thin Plates pellucid, shot into Angles of all Sizes, from the bigness of a Pigeon's Egg downward, to as small as one can discern them, and 'tis likely the Dust are also shot: These Grains lie mostly in, or upon Spar, which fills some of the larger Loads or Veins, except some few Loughs, or crystalliz'd Holes, some large, some small; 'tis found in the smaller Loads in Ribs, nearly as fine as the Grains or Shoots, or Grains of the same, or finer upon them, sometimes mix'd with a small quantity of Cockle. 'Tis found sometimes in Dust, or small Grains, in Ores of divers Colours, as black, grey, red, &c. mostly hard, very rarely soft; it is sometimes mix'd with Sulphur and Vitriol, sometimes there is a Rib of one Sort, on one

one Side of the Vein, and a Rib of another Sort, on the other Side of the Vein ; sometimes Copper Ore is found at another Depth in the same Vein. Some small quantities of Tin, are found in Floats or Squats, I have seen one Instance of small Grains of Tin, found in the lax Parts of the Edges of the Strata, by the Side of a small String very irregular, but in quantity worth working.

Lead is found in Ore mostly very friable, sometimes hard, mostly blue, but some small quantities of each Colour, as white and pellucid, white and opake, brown, grey, green, &c. and of various Contextures, as shot, diced, uniform, plated, fibrous, granulated, &c. in some places a Rib on one Side, in some a Rib on each Side, in some several Ribs, generally each of different Sorts ; in some places the same Rib of different Sorts, in some places fix'd between hard Sides, in some places naked and pure, in some places coated and mix'd with Spar, Caulk, and other Minerals, 'tis seldom native, I never found but one small piece ; 'tis not only found in Veins, but great quantities of it in Bellies, Floats, and Pipes.

Iron is found in thin Strata of Stone, in Nodules lodged some in, some between the

the Strata, in Veins, form'd in Ribs and Shoots, in Bellies, some in form of Ore, some like Clay, and some by it's Capacity attracted into the most regular and beautiful Figures, form'd, independent, round from a Center, striated, and compos'd of infinitely thin Spheres, divided into small Cones, some of them having attracted new masses, and form'd new Centers and Arches over them in like order; 'tis seldom found native, I have found it very pure, but never malleable or flexible, nor can Fusion in Fire ever make it so I think, because it is attracted into masses; 'tis generally found red, or of a rust Colour; in some Places 'tis found black, grey, white, &c. 'tis generally very heavy, and some of it very hard.

There are different Sorts of Ore, in the different Sides of the same Rib: Ribs of different Sorts of Metals, found one beside another in the same Vein, and of different Sorts, in the different Parts of the same Vein, as well horizontally as perpendicularly, and there is scarce any Metal found pure, but there is some mixture of one or more Sorts with it.

Spar is found in Veins, Loads, Bars, small Strings, Floats, Pipes, and Bellies, of all Colours and Tinctures, shot and form'd

form'd into all Figures, except round; of all Contextures, hard, tough, brittle, soft, &c. mix'd with, incloſing, and inclos'd by, all Sorts of Metals and Ores; and not only where there are Metals, but where there is none: If the Water, as it came out of the Strata, had run down, Grains, Shoots, &c. in the Veins, and Hematites in the Bellies, could not have been form'd there.

In some Veins, &c. there is Talk of ſeveral Colours, Textures, and Figures: In others, Mundick, Marchafites, or Sulphur, Antimony, and ſeveral other Sorts of Minerals, Soils, and Clays mix'd, the hard with the soft, among the Ore, by which the Ore of the ſeveral Veins are diſtinguiſh'd, and there are Veins and Strings of many Sorts of Mock-metals, whose Uſes are not understood.

Though the Atoms of Metal are ſo small, and ſo few in Number, and diſpers'd at ſuch Distances, that none of them can be ſeen remaining in the Strata, except thoſe of Iron; yet ſuch matter as came with the Ore out of the Strata, is viſible in maſſes in thoſe Strata. As Spar in Lime-Stone, ocrous Powder in Grit, Talk, call'd by ſeveral Names, as Cockle, Black-jack, &c. in ſeveral Sorts of Stone, and

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and always found in one or both of the Sides or Strata, which include the Vein; and where there is a different Sort in each Stratum, or Side of the Vein, at the same Level, or at different Depths, such is found in the Vein, and are Demonstrations, that as that Matter came with the Ore, that Matter and the Ore, came out of the next adjoining Strata.

After the Veins, &c. were thus form'd, and mostly fill'd with Metals, Ores, Minerals, Spar, &c. the Bars fill'd with Spar or Clay; the Cracks in the Ore, Spar, &c. fill'd with Plates of native Metal, &c. the Strata crack'd into Fragments, and nothing issiu'd out of the Strata, nor nothing pass'd but Clay, to fill the empty Spaces in the Fissures, where the Strata contracted further. At last some of those Fissures, either directly, or by Communication, reach'd from the Abyss to the Surface near directly, and crack'd the Crust through in several Places, at near the same Time, and the Water at the Surface began to enter into the Abyss, at those several Apertures in the Parts which are now Seas or Lakes, and now stand open, and perhaps at some small ones at Land, some open, and some perhaps soon after contracted and chock'd up, and

and the Water out of the Veins hurried down the Swallows, &c.

As soon as the Sphere of Water on the Surface broke in at every Place where one of these open Fissures was, it's Force being at the Bottom, tore away all the Fragments of the Strata, and all the Matter in them from every Side, which were small enough to be mov'd, hurried them in, form'd a Hollow or Valley near it's Mouth, and so the more distant Waters successively press'd in from each Side; and as they came, they with the Fragments they hurried along, beat other Fragments out of the Surface they hurried upon, and drove them in, thereby forming on each side of each large Apertures, the deep Seas, the flat Countries, and at further Distance, divided into Branches upward, took Advantage of the softest, loosest, or most friable Places, which happen'd where the Strata were thin, or most crack'd, or where the Edges of the Parts met; and as it made Furrows, and thereby Currents, they wash'd out the softest Matter, and undermined the Edges of the Strata, and the Water above, push'd Fragments down into the Currents, till it came to the Level, or to more solid Strata; left Mountains, Hills, and Rocks, where the thickest,

est, strongest, and least shattered Parts of Strata were, and where the thinnest, softest, or most shattered Parts were, form'd Vallies, Dales, and Gills ; and in the lowest Parts of them, the Channels, Rivers, and Rivulets, winding where it found the softest Strata; thereby leaving little Islands and Rocks at Sea, little Hills in the low Countries, and the higher Ground or Ridges terminating in Points towards each Breach between the several Furrows, the Water entering there made, and the Banks at Sea and the Ridges of Mountains at Land, where the Water, when it had torn off what it could, in Proportion to the Solidity of the Stone, and it's Distance from the Mouth of the Aperture, and sunk to the Level of their present tops, from the highest to the lowest in digression, divided the Part on each Side of those Ridges, making it's way to the Aperture on that Side, or down another Channel, to the same Aperture. And though, as the Water and Rubbish went down, the Atmosphere came up, and Gravity increased, till the Abyss was full ; yet as the Force of the Water, by it's quantity or depth being lessen'd, abated, it left some Fragments of Stone so large, as to form Islands, some in great Rocks, and the broken

broken Surfaces of the Strata of Stone, in the Seas and Vallies, covered with the Nodules, lodged in, and which were broken out of the soft Strata : The Fragments of the Strata of Stone, rounded and smoothed, by their jumbling one against another, and against the broken Surfaces of the Strata. Those which were more fryable ground to Gravel and Sand in that form, mixed with Clay or Earth : And so backward, the Dales with less, the Gills and hill Sides, with what it's last Force there broke off, and least worn. The Mountain tops, with wrecks of Vegetables, Shrubs, Trees, and what swimm'd upon it's Surface, which now we call Morass, or Moss, and in the flat low Countries, where the Surface of the Earth, was little above the now Level of the Sea, it made a halt, left a Sediment of Clay, Sludge, &c. uppermost, till at last the Abyfs was fill'd with Rubbish and Water, and the Water remaining, only fill'd the lowest Vallies, and form'd the Seas, and the Ground above that Level remaining dry form'd Continents, and large Islands of various Heights, Dimensions and Figures, and the Tops of the Hills, or of large Fragments, above that Level at Sea small Islands, and the naked Points, Rocks,

some few stagnant Lakes, where there had been small Apertures, and they choak'd with Rubbish, or contracted and clos'd, and the Channels the Rivers ran in, excepted.

So the Variety of the Soils upon the several Parts, or at least their Appearances, were form'd seldom from the Matter, which first settled upon the Part, only where the Surface of the Strata were left naked, nor often by the different Sorts of Matter, the Fragments of Stone driven thither were compos'd of, but mostly by the difference of Descents to, or Distances of, the Places from whence they were moved to the Places where they were left. where those Fragments were driven upon a small Descent, and a short Distance, they are not much broken or worn ; so that Soil was compos'd of Fragments, and what was worn off them, and those which went further still, were smaller and smaller, and afforded a greater Proportion of small Soil to the Fragments; and in many of the longest Courses, not only of those covered by the Sea, quite down to the Mouths of the Apertures, or, as Jonah calls them, to the Bottoms of the Mountains, but also in those vast Tracts of flat Land, in *Africa*, and other Parts, where they

they were driven an infinite Distance from the Mountains, before they reach'd the Sea ; those which were mostly Sandstones, are all beat to fine Sand, and that which remained spread upon those long Flats : and other Sorts of Stone, Chalk, &c. are beat to Clay, or Sludge, and in the flat Parts, often near the Sea, are left in those Forms.

The Metals, Ores, and Minerals which were formed and lodged in the Veins, &c. in those Parts of the Strata which were torn and carried away, as well in those Places which are now Sea, and in those Places which are Valleys, as in those Places which are Mountains, being also contracted and crack'd, broke, and went along with the Fragments of the Strata, in which each lay, some quite down, some to great Distances, and some to less, underwent the same Accidents, as Stone of like Hardness, Size, Weight, &c. did : And the Tops of the Parts of those Fissures which remain in the Shelf or Surface of the broken Strata, appear in the Sea and in the Valleys, as well as in the Mountains, where one has Opportunity to view them ; and when Gravity had given Matter another Tendency, and the Abyss was filled, and the Hollows in the Surface of the Shell to the Level of the

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Sea, and the undermost Fissures, which are open so far, to the same Level, and the Strata in the higher Ground and Mountains, with Vapours and Springs, the Strata could contract no further, some Tops of Mountains which are ragged, shattered, and dry, excepted : But on the contrary, all the Pores of the Stone below that Level, especially below the Level of the Surface of the Sea, would again be saturated with Water, and the Strata would extend and straiten the Veins which were not filled with Ore, &c. and the Apertures, at which the Water went down by Degrees, perhaps some to one Tenth of their Capacity, and close many ; nay, perhaps close all whose Edges were not much broken or worn by the Stone going down.

As soon as the Rubbish, composed of Parts, from very large to very small which went in, and Gravity reached the Center, it must form a solid Globle about the Center ; and as the Rubbish went down in Lines, and in greater Quantities from some of those Apertures than others ; there may be Prominences in some Parts, and greater in some than in others ; and tho' that Globe be immensely great, it would not fill the Abyss ; so between it and this Shell,

Shell, which I think is very thin, there must be a Sphere of Water, which fills the Space between ; and where there were any Chasms in the Strata of the inner Surface of the Shell, either perpendicular or horizontal, not filled with Metal, &c. the Bitumen, Sulphur, and it is likely, some Salts which emerged out of the Matter and Water, which went down, perhaps raised into and lodged in them.

If that Globe be disposed to move forward, ever so little, faster or slowlier than this Shell, it may shift progressively towards one Side, and vary the Center of Gravity of the whole, to each side successively, and have some Hand in the Motion of the whole ; and if that Globe be disposed to turn faster or slowlier than this Shell, by ever so slow Degrees, and there be any Prominences, they will shift from under the thinner Parts of this Shell, in the broad deep Seas, from whence the greatest Shares of the Rubbish went. And if Quantity of Iron in Parts of Strata, Nodules, Ore, or Clay, which is most frequently found in thin Strata, and went in there in greatest Proportion ; or the Position of the Parts of the inner Globe, to the open Apertures in the thinnest Parts of this Shell, and thereby the Quantity of solid Matter, or of

Matter more disposed to attract than other, have any Effect upon the Needle ; those which have may vary the Power of Attraction on the several Parts of the Surface of this Shell, and may direct, and vary both the Variation and Dipping ; and I think the Vapours for Springs and Rain, rise from that Sphere of Water, through the covered Fissures, Swallows, and Cracks in the Strata, through which the Water descended out of those Fissures into the Abyss ; and that Sphere of Water is constantly supplied by those open Fissures in the Seas, and salt Lakes, through which the Rubbish and Water went down, in lieu of what it emits, perhaps with this Exception, that Spouts and Tornadoes, when they happen, may rise through those which stand open ; for as each of those open Inlets, in Proportion to it's Capacity, admitted Rubbish and Water, with some small Variation in the Quantity of Rubbish, in Proportion to the Hardness of the Strata within it's Reach, at their Retreat from the Surface ; so now each receives Water in Proportion to the Extent of the Hollow it made, with some Allowances, as aforesaid : Thence come those Currents at main Sea, to those Parts where there are the greatest Apertures, and

and out of the main Sea through Straits, into the smaller Seas, such as the *Mediterranean*, &c. where the Apertures into the Sphere below, are larger in Proportion to the Quantity of Water, which by Rain and Springs falls into them, than those in the Parts of the main Sea adjoining, are to the Water which fall into them; and so perhaps, on the contrary, out of some of the small Seas into the great ones; and where there are Apertures, which are ready to admit faster than the Water comes to supply the Surface, and keep it at Level, the Tides will not run high, Whirlpools will appear there, &c.

If the Apertures, at which the Water went down into the Abyss in so short Time as is recorded, were now as many and as wide as they were then, the Abyss would have sufficient Communication with the Seas, to be always full, without any visible Draught; but as those Apertures which remain, were since only to supply the Expence of Rains and Springs, raised by some Action within, perhaps, it is necessary that they should not admit Water faster, than in proper Quantity, to keep the Agents at Work, and supply that Expence.

Since the antediluvian Earth was not created in the most commodious Figure at first, without Doubt, the Matter, when created, was placed so as to be put into that Frame and Figure, by being worked upon by other Agents; so that Things, which were created with it, and formed soon after, should, as soon as they were all formed by their Actions, naturally make such Alterations as would bring it to be so; and without the Alterations, those Agents of Course were to make in it, which, if it had been created perfect, would have put it out of Order: And we may reasonably believe, that if a Settlement of the Corpuscles out of the Water, would dispose them into such Order as would best answer the Ends of the Creation, it was created in Corpuscles, and settled from the Water; and if they had formed any other Figure but a hollow Sphere, the Waters could not naturally have gone off; and if it's Surface had not been smooth, the Waters, at going off, could not have given the Surface it's proper Form: And if the Earth was created in Corpuscles, and settled out of Water, or round without it's present Form and void, covered and hid, with a Sphere of Water; the Water, which was upon the Surface, and covered

covered it, and those Parts of the Earth which the Water took out of the Surface, to give it it's Form, were carried into the Void, and formed a Globe there.

If there was a Globe within the antediluvian Earth, and the new inner Globe was made larger than the old, that would increase the Power of Gravity, and diminish the Power of Attraction, and that would abate the Power which produces and carries on Vegetation, and so the Produce of the Earth ; diminish the bodily Powers and Abilities of Man, and all living Creatures, both as to their Bodies, and everything without, make them want more Food, and have more Difficulty to get it, more Labour to remove their own Bodies, and all other Bodies, shorten their Lives, &c. And if the Globe within was enlarged, it is likely the Dimension of the Sea without was extended, and that would make the producing Parts less, Commerce more difficult, &c.

There is another Difficulty which has been accounted insuperable, to shew how Shells, &c. could be lodged in Strata, as they are found, to the greatest Heights in some Places, to the greatest Depths in others, at the Tops of the highest Mountains

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tains in heavy Stone, and none in lighter Stone of the Strata below; and in some large Tracts not one to be found at any Depth.

If there had not been such a Globe within the Shell of the antediluvian Earth, but a Shell full only of Water, with deep broad Seas as there are now; and the Corpuscles of Stone could have kept their Places in the Water, each over the Place where it was taken up and subdivided; there the Surface would have been formed in the same Figure it was before, Seas where Seas, and Mountains where Mountains were; and we should not have found any Shells, either on the Tops of, or in the Mountains; and where a Stratum had settled, next above the Level of the Gills, Dales, or Vallies, on each Side, and laid the Foundations of a Mountain, the next Stratum, if it came short of it's Breadth, would have terminated in thin Edges, and if it settled of the same Breadth, the Edges must have over-shot, terminated thin, and formed a Cap, at least, the third must have been so formed, and all the Strata above in Arches; and when the perpendicular Fissures had been made in Mountains so formed, the Water would have pushed into them at the Edges of the Strata,

Strata, and hindered them from filling with Ore; and if no great Quantity of the Surface had gone off into the Abyss, finding their Strata in those Figures, and the Veins in them open, and the Fragments of their Edges torn with the Water, and spread in the Vallyes, would have been an Evidence that the Mountains were formen at the Settlement: But I think this could not be; for if nothing but Water had came out of the Abyss, and thought all the Matter in the Strata, Rubble, Shells, &c. had risen right upward from the Center, and there had been no Motion in the Sphere of Water, after the Matter was so dissolved, and taken up, till the Matter settled; yet the Corpuscles of the Matter which formed the antediluvian Mountains, would have diffused themselves side-ways into the Seas and Vallyes, till the Water had held an equal Share of them, over each Part of the Surface, and by that Means no Shells would be lodged in the Places where the old Mountains were, and the Crust would have been level; and if it's Surface had been form'd, as I have supposed, there might have been Mountains formed where it had been Sea, and Shells in them, and where the old Mountains were

were, and none in them, and the Shell would have been much thinner.

But I think there was a Globe within ; and if it was formed, as I suppose without such Connection of the Parts as are in the Strata, it would dissolve first, and come up with the Water out of the Abyss at such Apertures into the Seas, as there are now, and so return what the Waters at their first going off, had taken down, and make up the Deficiencies in the Thickness of the Crust in the Seas and Vallies ; and also a Surplusage in the Water, which covered and reached an immense Height above the Tops of the highest Mountains, and with it some of the Sea-shells, Sand, &c. which were loose, and make upwards, towards the Surface of the Water, before the stony Crust was dissolved. If that had settled upon the Crust, we should have found Marks of the former Surface. But I think, after that, the uppermost Courses of Strata would rise up in Parts, and dissolve by Degrees, as they came further distant from the Center, and so in Succession, till all were raised up and dissolved, and kept separate, or below that Matter which came out of the Abyss and Sea, save only the Matter in the Mountains

tains diffusing a little, till all the Water were equally filled at the same Depth : And perhaps it is some of them only that are so thick and free from Shells ; and that the thinner Strata are Parts of that Mixture of all sorts which came out of the Abyfs, or were loose on the Surface of the Strata, separated as aforesaid, and to the Ends aforesaid.

Finding such sorts of Shrubs and Plants lodged in the Strata here, as are now only found growing much nearer the Equinoctial Line, and Shells of such sorts of Fish as only live now in the Seas, of far distant, or hotter Climates, it has been reasonably supposed, that there were some mighty Currents of that Length before, or when the Water went down, which brought them hither : But I rather think, that some sorts of Plants could grow, and some sorts of Fish could live, before the Flood, in Climates where those sorts of Fish do not, or cannot, live, nor such sorts of Plants will not grow now.

The Water having taken away the Strata which lay above the present Surface of the Earth at Land and Sea, to form the inner Globe, and a new Surface of the Strata, and left what it had broken off, and could not get down by the way upon some Parts

Parts of the new Surface of the Strata, and thereby constituted a mixed Surface, Part of naked Strata, Part of Rubbish, as appears at Land, and would have appeared in the same Order at Sea, if the Water had all gone down; we are most particularly to consider the Surfaces above Water, and so deep as we have Occasion to go.

The largest sort of Fragments, which broke off from the perpendicular Ends of the Strata, or Scars, by being undermined and pushed down, and adhered together, are some of them inverted, in all Positions, some stand edge-way, and form small Islands, some are left in Form of Rocks, both at Sea and in the Dales and Vallies at Land, some Fragments of hard Stone of lesser size are found in Trains, from the Tops of Mountains, as the Water took it's Course, thence quite down to the Sea, and doubtless on to the Apertures, and into the Abyss; some from the Parts of Strata remaining, and some from the Strata, which were above the Tops of those Mountains, and are all broke and carried down; each from the largest to the smallest, with Strings and Threads of Ore, Spar, or &c. which were formed in them before they were broke off from the Strata.

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The vast Beds of Nodules of all Sizes, down to Gravel, the smaller Fragments of Strata down to Sand, Clay, &c. and the Fragments of Metal, or Ore among them, which were going down towards each Aperture, and stopped upon the present broken Surface of the Strata, are in the Vallies as irregularly disposed as such a Hurry could place them, perhaps some as they first stopped, the most shifted after several Refts; some stopped by hard Strata, which would not go, and give Way; some left in Hills by the soft Parts of other Strata giving Way, and the Water taking other Courses, some mix'd all Sorts together, some in Beds each of one sort like Strata, or Sediments from Water: (and which have hitherto been taken for Strata) most like Waves, hurried one over another in long Plains, the lightest going fastest and furthest; in great Descent, the heaviest going fastest; further upward, towards the Tops of the Mountains, where the Fragments were of still fewer and fewer Sorts, and the Water that brought them had fewer and fewer Directions, till at the Side of each Mountain, the Water and Fragments had but one Direction, and the Fragments stopp'd at once; and remain there, they are

are more regularly placed, so that by their Situation and Condition, and the Situation of the Ground near them, it may almost be demonstrated in what Line they came, how far they have come, in what Succession of Time each came, &c.

The Surfaces of the Strata in the Currents at Sea, in the Rivers, along the Valleys, and the Rivulets, down the Dales and Gills, and between each of them, and the next on each Side, are by the Currents of the Water which were at it's Bottom, or upon those Surfaces so formed; that not only they, but the Surfaces of the Rubble, torn out of, and driven by the said Currents upon them, each and both make Lines declining from the Horizon, or falling from each Side toward the Current, and down the Currents to the Apertures, as Water in that Direction would tear the one, and hurry the other; so that no Hollows, such as Disruptions, would have made, remain; nor scarce any Water stands, or is much deeper in one Part than in another at Land, except some few fresh Lakes, where the Strata are whole on all Sides, and which doubtless had Fissures into the Abyss, which were stopped with Rubbish during the Flood, or by the Extensions

fensions of the Strata soon after, and now discharge their Water along the Surface; and if the Apertures were of the same Capacity they were then, and the Water in the Sea could go down, the Rivers would be continued along those Currents to the Mouths of the Apertures, and the Surfaces now covered would appear in the same Order as these at Land. In Gills, where the bottom Strata, and the Edges of those on each Side, are naked, those Edges mostly tally, and lie on both Sides in the same Order of Succession, of the same Species and Thickness, nay, even each has of the same Bodies lodged in it, as it's Tally has on the opposite Side; indeed there are some Exceptions, for where the bottom Stratum is intire, the Edges of Strata of different Sorts have met above, and left those Edges soft which gave the Water an Opportunity to make a Furrow soonest there; and wherever those Rivulets, or Rivers make Falls, or run upon the naked Strata, and more plainly where the Miners pursue Veins under Gills, it appears that the Strata they run upon are intire, and in the Position they were

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formed, Fissures or Cracks excepted. The Sides of the Surfaces of the Strata, which rise slowly, are generally covered with Rubbish, and nearly smooth. The Scars in the Sides of Rocks and Mountains, in some Parts perpendicular, some broken raggedly, some slopingly, with Linches, or flat Places, at the Termination, or horizontal Division, of some of the Strata; some naked, some of each Sort covered with Rubble, in a sloping or declining Condition, some near the bottoms regularly, but generally higher up very irregularly; the Cliffs in the sides of Gills, Rivers, and Coasts of the Sea in the same Condition, some covered with Rubbish, some left naked, and some made so by washing away the Rubbish since at Land by Floods; on the Coasts of the Sea by Tides and Winds, in Form of Sand, and some of the perpendicular Scars shattered by Weather, have dropped so many Fragments as have formed a Brow to each of loose Rubble, almost to their Tops; and there is no other Difference between the Surfaces of the Strata in Gills, Dales, and Vallies at Land, or between those at Land, and in the Sea; but as those which are nearest the Apertures, are torn the deepest; nor between the Surface of the Rubble

Rubble at Land, and that at Sea, except what Streams, Winds, and Tides, have done with Sands, in the Mouths of Rivers or shallow Seas, and what Heat, Frost, Rains, &c. have done on the Surface at Land since.

The Water at it's Retreat having broke off the Ore, Spar, Plates of Metal, &c. which were in those Veins, or Parts of Veins, together with the Fragments of the Strata, which form'd their Sides, as deep as the present Surface of the Strata, and carried them away at each Depth, with the Fragments of the Sides at that Depth ; we are next to consider, in what Condition and Situation, each of the several Sorts of them, which remain on the Surface, are found.

Many large Masses of Caulk and Spar, some of them having small Masses, or sparks of Ore in them, and of other mineral Bodies form'd in the Veins, which are hard and tough, and did not by Contraction, crack into so small Plates, Cubes, &c. as most of the mineral Matter did, or where those Cracks are fill'd with threads of Spar, and the Bodies re-united are found entire, or partly rounded, scattered from the Veins, where they were form'd along the several Courses, the Wa-

ter took in the Brows, Gills, Dales, and Vallies, to considerable Distances; there are some Trains of distant Sorts, each Sort from one Vein apparent in the Surface of the Rubble, where the Descent is considerable for several Miles, quite down to the Sea.

The Fragments of Ore, with, or without Grains of native Metal in them, crack'd into small Sizes, which lay incorporated with Spar, or other Matter, which was tough and hard, and were borne off with the Fragments of the Strata on each Side of the Vein, and hurried away, endured the jumble, and are to be found both near and at great Distances in Masses, amongst the Fragments of Stone they went with ; the harder, rougher, and steeper the Surfaces or Shelves, the Fragments of Ore or Spar, with Grains of Metal in them roll'd upon, the harder and rougher the Fragments of Stones were which rolled with them, the greater the Descent, and the further they were driven, the smaller the Fragments of Oar or Spar will be beaten, or the smoother and rounder they will be worn ; and on the contrary, the softer the Surface, especially where it was Rubble, they were driven upon, and the softer the Fragments were, they

they were driven with, the lesser Descent and the shorter the Distance they were driven from the Load or Vein, the larger and more angular or rougher they will be found; where the Surface was so steep that they rebounded at each fall, and touched it but seldom, (tho' how far they would rebound at that Depth of Water, is not easily ascertained) or where there were perpendicular Falls, they might be broken, but not very much rounded.

Where the Fragments of the Strata, on the Sides of the Vein, were of near the same Figures and Sizes, of near the same specifick Gravity, and nearly as tough and hard as those of the Ore, they would go together, and be found in the same Condition.

Where the Fragments of Strata of the same specifick Gravity, and of nearly the same Figures, but much larger than those of the Ore, were driven down a declining Surface, where they would at first, with small Impulse have tumbled, if there had been no Water, would go faster than those of the Ore, and if they rested on a broad Linch, or at the Bottom, they will be found lowest, or if nothing intervened, next the Shelf; and those of the Ore, and

those Stones broke to it's Size, upon them ; and the smallest of both uppermost. If the Surface were much steeper, those of Stone which were large, would go much quicker, if the Surface had a little less Descent, those of Stone which were large, would go where those of Ore might rest upon the Surface, or small Linches, when they both came so far upon the Surface, so near approaching a Plain, either on a broad Linch, or at the Bottom of the Brow, that the acquir'd Force was spent, the Ore and smallest Parts, would go fastest and farthest ; and when they reached the Stream, those in the middle faster than those on each Side ; if the Fragments of Stone were approaching to flat, and those of the Ore nearer square, the Motion of those of Stone, upon the declining Surface, would not be so much quicker, nay, if near flat, perhaps slower than those of Ore.

Where Fragments of the Strata, of much less specifick Gravity, (which is generally the Case) and of near the same Figures, but much larger than those of the Ore, were driven down a declining Surface, where they would at first, with a small Impulse have tumbled, if there had been no Water ; their Velocity would be much

much less, and so in Proportion, as the Descent less'd, when the Stone and Ore came into a Stream nearer level; the Parts of the Stone which were broke small, would go foremost, and the Ore perhaps, with some of the largest Stones hindmost.

Where the Fragments of the Strata were soft or friable, or fissile, and the Matter in the Vein hard at some Distance, in proportion to it's Texture and Accidents; the Stone was beat to Sand or Sludge in the Jumble, driven away, and the Ore, &c. remain alone in Masses, on the Hill-sides, and Shelves, and at the Bottom of the Furrows, and in some Places great quantities of it are found, at a chequer, where the Water was stoped by a hard Part in the Strata, and forc'd to make a sudden bend sideways.

As soon as the Ribs or Masses of Ore or Spar crack'd into Fragments, with Plates of native Gold or other Metal form'd between them, but continuing in the Vein, with their Sides near one another, and seemingly entire, were borne aside with the Water, among the Fragments of Stone, which compos'd the Sides of the Vein; those Fragments of Ore or Spar, whether hard or soft, heavy or light,

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would most of them separate from each other, and drop the Plates of native Metal there close by the Vein, and the Plates would rest, or be moved with the Matter they fell upon or among, and not with the Fragments of Ore, Spar, or Stone ; and any two Fragments which had a loose Plate between them, or one that kept them longer together, by Parts of the Plate entering into cross Cracks, so that they were driven further, would drop the Plate whenever they parted.

Where the Spar, or Matter, the Metal, or Ore was form'd in, was fryable, or soft, and the Fragments of the Strata hard, the Surface of the Strata rough and steep, so that it could not endure the jumble, but was presently beat to Powder, and carry'd away, there only the Metal is left behind, and found in Knots, Plates, or Grains, and the Ore, if it be heavy and hard, in Shoots or Powder.

The Ore which was broke off much higher than the present Surface of the Shelf, or Backs of the Veins, was generally carried to a considerable Distance ; and unless the Fragments of Stone were beat asunder, or were much larger, and so were tumbled down faster, or were lighter, and driven faster, and separated from

from it, that Ore is so dispers'd, and mixed among Stone, &c. that it is not worth looking after, but the Ore which was broken off with the Fragments of the Strata, which composed the Sides of the Veins, next above the present Surface, when the Water abated, came last down from the Veins in the Hills, could not go far, and if it were not very soft, is scattered from the Vein, down the Side of the Hill, mostly on Flats or Linches, and so on, down the Troughs, Gills, and Rivulets, in the same Course or Direction the Water took from the Vein, least in steep Places, more on Flats, and most at Eddys or Stops.

Where there was vitriolic Salts, or, as they call it, Sulphur, which generally holds such Salts in the Ore, and it was so hard, as to endure the Jumble; except it be lodged in Clay, those Salts, by the Assistance of the Air or Water, have dissolv'd most of it, part is washed away, and part remains in blackish Powder, and if there were any Knots, Plates, or Grains of Metal in it, those of such sorts of Metal as those Salts will not dissolve, remain.

Before Directions to trace each Shoad to the Part of the Vein from whence it came

came, or to discover the Veins from whence no Shoads could come, or to pursue them when discover'd, can be understand; 'tis necessary to shew the Orders, in which the several Successions of Veins were form'd, the several Accidents at forming them, and the several Alterations which have been made since they were form'd, and the several Appearances the different Parts of each, viewed in different Directions exhibit.

Suppose the deepest Strata to be thickest, and the Bottom of the first Fissures, which extended through them, stood open into the Abyss, the Fissures in the next Strata above, which, by what we see generally crack'd on the same Point, or in the same Direction, though seldom perpendicularly over that next below, must have had Apertures or Conveyances for the Water into one of those below, either along the horizontal Division, or along some Part of a Stratum between them, which is generally of Chiver or Clay, or soft Matter, which emitted no Metal, but crack'd into many small Threads now fill'd with Spar, and were Cheques to hinder the Water from passing through too fast, where the Veins below and above are wide, or the Water must pass by some Cracks,

Cracks, across one of the Strata, which near the Surface are rarely now found open, and at considerable Distances from each other, which in work'd Mines, they call Swallows; and where they reach to Day, admit Water at wide Mouths, stand in rows, at like considerable Distances, and were 'tis likely, Swallows to Veins now born off, are call'd Shakeholes; and so each Fissure, through each Stratum, or several Strata upward, must have passages to Swallows, to discharge the Water through the others downward; for no Fissure, except the first, could be form'd wider, or admit more Water than once full, nor more Ore than with that Water, but by means of the Water getting Vent downward, the first into the Abyss, the next into it, and so in Succession; near where those Swallows in Veins are, and are large, there is little Ore, but some Water, Spar, and Stalactite, and sometimes all has gone down, and that Part of the Vein is empty; as sufficient Quantity of the Ore could not have come into the upper Veins, without Passage for the Water, with which it came through those Threads, Swallows, or Cracks, to lower Fissures; so sufficient Quantity of the Water, could not have got out, to let the Strata

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Strata subside, 'till the Masses came close. How far the Water and Ore could issue out of the Edges of the Strata, into a Fissure, must depend upon the different Porosities of different sorts of Composition of Stone; but suppose one Fissure made in a thick broad Stratum, and the Water had Vent down, the Edges next the Vein must settle most first, and so less and less backward, as far as the Water could come, and though perhaps the Settlement, in that Direction, added to the Power of Attraction, might make the next Fissure at that Distance nearly parallel; yet if there happened to be no other Fissure in the Stratum below, at proper Distance and Passage to it, to give Vent to the Water, the Fissure could not widen, nor the Stratum settle, till Vent happened, and if it happened not, that Fissure would only be a Thread of Ore or Spar, and the Stratum would contract in other Directions into small Cracks, and the Water would be afterwards raised into Vapours, and so the Stratum would decline from the Thread or String to the Vein, be more solid next the Vein, have fewer Cracks there, &c.

By this Means, when one Stratum composed of large lax Masses settled, with much

much Water in their Interstices, and the next Stratum above was composed of small close Masses, with little Water in their Interstices, but nearer solid; that Part of the lower Stratum, which lay next that Part of a small Fissure or Vein, where there was a Vent for Water to go down, would settle more than that above, and leave it, and form a hollow space between the two Strata, widest next the Swallow in the String, and straiter at further Distance; such are often fill'd with Ore, &c. and when they are regular, are called Floats or Squats.

In some Places, such a Stratum, whether from Cracks, which gave more Vent in one Place than another, or what Cause has not been sufficiently observ'd, has settled and contracted sideways at once, bended very irregularly into Hollows and Ridges, and so form'd Holes, here a large one, there a small one, here the Sides meet, there open again, so on parallel to a small Vein or String; in some Places close, in some at a little Distance; these they call Pipes, and most commonly are where Lead Ore is found.

In some Places, a Stratum not very thick near a String, has not settled, but contracted sideways, and form'd in one Place

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Place a great hollow Space, in another left several Fragments, with several Spaces between them on each side, perhaps after these, another hollow Space, sometimes Fragments, and very small Openings between, and so on in a Line, without any known Order, these they call Bellies; they sometimes are where Lead Ore is found, but most commonly where Iron Ore is found. There has been no Rules laid down yet, to pursue these irregular Sorts, other than to pursue the mineral Matter or Soil, whether the Space be wide or strait, in what Direction soever it lies.

There are Instances of a few small in *Cornwall*, where Grains of Tin are found, form'd in the Interstices of the porous Parts of a sort of Sand-stone, always by the Sides of a small String of Spar, which runs Veinways, those porous Parts with Tin-grains in them, lie here and there, without any Rule or Order, and the more solid Parts of the Stone between, have no appearance of Tin in them.

And there is an Instance in *Cumberland*, of a strait large String, with little or no Ore in it, whose Sides are of flakey, twisted, hard, blue Stone, and about a Foot from the String, on each Side a little greyer

greyer than the rest, but no appearance to the Eye of Grains, or any Sort of Ore or Metal, yet formerly they cut out all that grey Part of the Sides, and melted it for Copper.

It appears pretty plain, that in some Places, where the Water which settled in the Interstices, did not get sufficient Vent by Fissures, either out of the Strata or Nodules, so as to let the Strata become thinner, and the Masses come together; that the Masses of Stone were attracted one towards another sideways, and drove out the Water into Spaces by itself, in some Places in the Strata, so as only to straiten the Interstices in one Part, and widen them in another, in some Places to contract every way, from a Point or Line, and form a Hole or Lough, in Nodules lodged in Strata, to attract every way from the Center, and leave a hollow in some, to contract or thin each Shell, so that tho' they bo entire, they may be moved one within another; in some Places the Parts of the Strata (environ'd by others which did not give Vent) not only contracted in small Directions, but crack'd in several Directions, and form'd Pipes, Bellies, &c. where the Water got off before the Strata ceas'd to settle, and the Corpuscles

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parties of Metal ceased to move, those hollows are fill'd with Metal, Spar, &c. and where it did not get off till after, they remain open, with perhaps a little Spar; or a few crystalline Shoots on their Insides. That the Water fill'd and stood in the Bellies is plain by the Nodules, call'd Hæmatites, being form'd in them, that they had small Vent for Water downwards, is visible, because they are always found by small Strings, and that most of these small Strings were form'd late, because they are chiefly full of Spar.

After the metallick Veins, Floats, Pipes, Bellies, &c. were formed and filled, suppose one of those Veins, or Loads run through a thick broad Stratum East and West; if there happened to be by cross Strings and Swallows into other Fissures below, more Vent for the Water downward, as for Example, the East End than at the West End, the East End of the Stratum would settle more than the West End; and perhaps such Accidents were the Occasion of breaking the Strata, and forming those Fissures, chiefly observed in Cornwall, called Cross-bars, and Cours-bars, and letting the East End of the Strata sink, and that Part of the metallick Vein, or Load, formed in it. Indeed, these

these Accidents, in any considerable Degree, only attend the thick broad Strata, where the Water had not Time in their sinking, to rise upward, and where there are few Fissures, they large, and at great Distances, so that the Water could not get out from the Middle of the intire Parts; to the outsides, or the sides of the Veins ; and they lie so low, that the Miners cannot work through, and see under them, and are so rare, that we have not sufficient Opportunity to make sufficient Observations on them. There are some small but very plain Instances of this Kind in the Strata, where Coal lies, which they call Exchanges.

But to return to the metallick Veins and Loads, which differ in nothing, but that the hading Veins, which incline much from perpendicular, are in *Cornwall* called Loads ; and the more a Vein of the same Breadth, with one perpendicular, inclines, the more Ore, or, &c. it contains, between the Surface, and the same Depth. Those Veins, which are found in flaky Stone, whose Plates lie most irregularly, have broke the furthest from perpendicular.

The Veins in the thick Strata generally go through them in one Direction, are wide, and lie at great Distances : the thin-

ner Strata have more Veins in them, but they are straiter, and so in Proportion, with Allowance for the different Dispositions of Stone to contract, till at last, in some Places, the highest Strata have only very small Fissures or Threads made last, and filled with Spar; so that the Miners there sink, perhaps a vast Depth, before they get through those Strata which cover the Vein (which they call Lidds) and come to the Oar; and when they are got into the Vein in some Places, it goes down out of Reach; in others, after they have passed those thin Strata called Lidds, come to the Vein in sinking, they come to it's Bottom, terminating upon a Bed of Chiver, Clay, or, &c. sinking through that Bed, they meet with thin Strata, and driving a little aside, they meet with Leaders or Threads of Spar, and deeper, thicker Strata, and another Vein, which they call an Underset, where those Lidds are borne off, and Part of the Veins in any of those Setts, with the Surfaces of the Strata, in which they lay; their Tops or Backs stand either covered with Rubble, or naked to the Day; in some Places the Lidds are only broke off Part of a Vein at the side of a Gill, or Dale, and the rest of the Vein higher up is lidded. In some Places, especially

specially near the Level of the Sea, as the Mountains of Cornwall are, compared with those far inland, perhaps several Sets are borne off, and Part of those vast thick Strata, and the Backs of the Veins are naked all along.

The Veins, or Parts of Veins, whose Tops were broke off, and their Backs lie naked to the Rubble, or to Day, yielded Shoads in Proportion to the Depth which was borne off, the Wideness, or Quantity of Ore, or Metal in that Part, borne off the same Depth of those which inclined more than of those which stood perpendicular in Proportion to their Inclination. Where the Vein happened to be borne off to the Bottom, or a Flat-pipe or Belly, was torn out; there may be a Shoad, and no Flat-pipe, Belly, nor Vein, to be found, by tracing, or pursuing the Shoad, and the Under-set, if there be one, must be sought for in the same Manner, as they do for Veins which are lidded.

The mettallick Veins in the same Country, but more especially in the same Strata, run upon the same Point, and nearly parallel. In this Island, mostly near East and West; sometimes one of them extends several Miles in Length, or quite through the Stratum, keeps entire, or divided, not

till it come to each Edge of the Stratum, and there splits into several small Fissures, or Threads. In some Places the Stratum has contracted more in one Part than another, formed some Parts of the Vein wide, and others very strait, which strait Places they call Twitches. In some Parts the Stratum has cracked into two Places near together, for a little Space, formed a Chip with an Edge at each End, so that Part of the Vein is on one side, Part on the other, which Chip they call a Rider. Sometimes where the Riders are very large, they stay in their Places; in some Places where they are not so large, they have sunk till the fides below stopped them, and each forms a wide Part where it came from, and two Twitches where it is found. In other Places where they are very small, they have sunk down to the Bottom of the Vein.

Where the Stratum contracted only in Part, it formed a Vein which extends to one horizontal Edge of the Stratum, but cracked out into Threads, and does not extend to the opposite Edge of the Stratum. I have seen no Instance of any Stratum which did not crack through on the underside; but I have seen several Instances of Veins split into Threads near the Top of

of a Stratum; whether some of them per-
vaded or no, I am not certain.

Whether one of the sides of the Vein
in a thick Stratum, which is uniform, has
sunk more than another, is hard to prove;
but in some of the thin Strata, where each
Edge tallies, the one side has sunk a little
more than the other; and where the Stra-
ta broke unevenly, and some protuberant
Edges, in settling, have struck against the
other side, they are broke, and hang there
in that Order. If in any Part such a Vein
split into several Strings, the String where
there are Marks of the one side sinking, is
the most likely to be pursued.

In some Places, those I have observed
mostly where the Strata are not very thick
nor broad, where the Matter which formed
a Stratum of one sort of stone which sub-
sided, terminated, and another sort of
Stone commenced, a Fissure would soon-
est form there; if it happened in or near to
the Parallel of the next Fissure, or at right
Angles, to the Motion of the Parts of the
Strata by Attraction; there the thicker
Strata joined very close, and the Vein
seems to be formed by the contracting of
the Strata, and not by cracking, and
the two sides are of two different sorts of
Stone. Where the Stratum on one side is

pretty thick, and there are several thinner against it on the other side, the thick Stratum generally hades, or shoots under the thin ones, and the Edges of the thin ones are soft and irregular ; where the Edges of several thin Strata compose each side of the Vein, they over-lapeach other, their Edges are soft and broken, and the Vein irregular ; in some Places, many irregular Cracks, much Soil or Clay, and little Ore ; and the Edges of the different Strata on each side are generally a little thinner than the Parts at farther Distance, as the sides of a Fissure sunk more than the rest of the Strata ; so when the experienced Miners find two Strata, or Parts of Strata, inclining, or dipping towards each other, there is some Hopes to find a Vein ; and where a Vein which has each side of a different sort of Stone splits into Strings, when they are in a String which has the same sort of Stone on both sides for any considerable Distance, it is a Proof that they are out of the true Vein ; and it is likely these Veins continue little further than their sides make that Line.

For some time after the Flood was gone off, Plates of naked Metal, the Fragments of Ore in Shoads, the Back's of Veins, &c. whose Tops were broke off
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the Ends of Veins, where in forming Gills, or Dales, the rest was torn away, were exposed to View. In Time, Nitre in the Air, Heat, Frost, Rain, &c. have dissolved the uppermost Fragments of Stone and Ore, reduced them to Powder in Form of Earth, or some perpendicular Cliffs have dropped Fragments, hid their Faces, and formed sloping Brows, or Water has washed down Sand and Earth from above, and framed a Turf on Brows, &c. where such Fragments lay, or Tops or Ends of Veins appeared; as we see the Stone, Rubbish, Waste of Ore, or Coal, drawn out of, and laid at, the Mouths of Mines, Coal-pits, &c. some time ago, dissolved, formed into Turf, and covered with Vegetables.

In civilized Nations, all the Veins, Shoads, &c. which lay naked, or were easily discovered, or worked, are gone; for Gold, which was antiently, and almost to this Time, found mostly upon the Surface of the Earth, was found in greater Plenty in the Days of *Sohmas* than now; and perhaps their Silver and Copper was most of it found so. In *Africa*, these Miners will have the Advantage of finding all the Backs of naked Veins, all the

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naked Ends of Veins, all the Shoals, &c. untouched, or not robbed.

There is no great Difficulty to discover Shoals from, or the Backs of those Veins, or Loads, which are wide and naked, or open to the Top of the Shelf, or only covered with Rubbish; But the greatest Difficulty is to discover those Shoals and Veins, which are very small, or those Veins which are lidded to twenty or thirty Fathom deep, and there first formed in small Threads.

The Miners, Budlers, or Washers, who have worked in Cornwall where the Shoals are large, the Veins wide, and their Backs naked to the Shelf, where there is no Difficulty but to work out those Parts which hold most Tin, or will yield Profit, may be the fittest Men to discover and work such Shoals and such Veins; and if Gold be found in Grains, dispersed in wide Veins of Spar, as Tin often is, they may do well; but the Miners, who work in the higher Mountains more inland, where the Shoals are small, only from Threads, and where the Veins are lidded and deep, and are used to discover them by other Means, and are acquainted with the Accidents and Difficulties which attend the Pursuit of strait Veins, are more likely

likely to discover and prosecute the Veins of Gold, if they should prove strait, and some of them should also be sent.

If good Terms were advertised, doubtless several who have seen and worked in the *Spanish* and *Portuguese* Mines in the *West-Indies*, and are now in *Europe*, some in *England*, would come in and go to *Africa*, and would shew all their Methods of discovering and working.

The Miners ought to carry Samples of all sorts of foreign Ores, that they may compare them with the sorts they find there; because the same sort of Metal is found in very different sorts of Matter, of very different and unlikely Appearances; we have had several Veins of Copper, nay even of Lead Ores, which because of their strange Appearances, have not been known to be so till within a few years last past.

Upon their Arrival, before they declare their Intention, or begin to search for Shoads, they should get what Information they can from the Natiyes of all the Places where they find Gold, and of all the Methods which they use to find, work, and cleanse their Dust; because they may in Ages, by Chance or Industry, have found Places where Shoads are, and Methods how to work, and separate them, which Strangers,

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Strangers, without their Assistance, may never discover.

And when the Company's Ships, or others, go with Slaves, or, &c. to *Brazil*, or to the *Spanish* Continent, or Islands in the *West-Indies*, if they could procure any of the Workmen, or those which have made their Escapes, or purchase any Slaves, who have worked in their Gold Mines, or at washing or refining it, they would not only be of great Use to inform the said Miners of their Methods, but would perhaps endure Labour in that Climate, much better than *Europeans*.

If there be Part of the Gold Mountains where the Miners can get no Discoveries from the Natives of Shoals or Veins, they should search the Dales, Gills, and Sides of the Mountains, for masses of Spar, or such Bodies as have been formed in Veins; and if they find any such, they should break them, and search to find any Sparks of Ore, or Grains of Metal to know, if any, what sort of Metal those Veins, from whence they came, contain; if there be any Appearance of Ore they understand not, they should try to melt it; if there be Grains of any sort of Metal in it, they should powder the whole, wash them out, and assay them; if they meet with what they

they want in them, the next Step is to search for the Shoad.

If they meet with no such Masses, they should search large Fragments, or Rocks borne down, or fallen down from the Scars or Clifts, to find if there be any Strings or Threads in them filled with Spar, or other mineral Matter, and examine, as aforesaid, what is in them, and if they find what they want in them, they must trace from whence they came; for if there be Gold formed in Veins at that Level, some Threads, with Grains, will be found in the large Fragments or Rocks.

If any of the Tops of the Mountains be naked, or the Shelf appear, they are to search if they can find the Backs of any Veins, or Strings; if they find the Backs of any Veins, they are to examine them, if any Strings, to do the like; and if they find Strings, which only hold Spar, they are to observe the Range they take, and examine the naked Clifts, or Scars, where their Ends may break off, to find if they meet not together, and bear Metal at greater Depths; if they cannot find the Range of the Veins, as above, they must search the Ends or Edges of all the naked Clifts.

If there be any Chasms in the Clifts, or any Shake-holes that they can get into they

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they are to search for Fissures and Veins in them ; for tho' they are Signs of Defect of Ore, or Metal in the Part where they are, rather than of Plenty, yet they are Signs of Veins, many are discovered in them, and in Countries which afford Ore in the Fissures, they think it worth while to drive Vein-way, and sometimes cross-ways out of them. At Places where large Springs, or considerable Quantities of Water issue in wet Seasons, out of the Cliffs, they should examine if it brings any Grains or Dust, or any Soil, orous Matter, or Salts, which are found in the Veins with Gold.

If the Mountains be covered with Rubbish, and none of their Surfaces or Edges of the Strata appear, they must either search for Shoals, or bare the Shelf (as soon as they can discover which Way the Threads go) transverse, or at right Angles with the Veins. If the Mountains be covered with Morass, or Peat Earth in a dry Season, if they set Fire to it it will burn to the Shelf.

As Gold exceeds Tin in Value, it will be worth while to search for it, where it has been driven to greater Distances, or is found in smaller Proportion than they have searched for Shoals of Tin ; and as the Matter broke from the Veins, went down

down into the Rivers and Sea, if the Masses of Spar, or mineral Matter, the Gold was formed in continue whole, they may be found at a great Distance worth gathering out.

Where there is a Cataract or Water-fall from the Gold Mountains; either constant, or in great Rains, into a River, there what was borne down at the Flood, or since, except it be Metal, or very hard, will be beat to Sand; and if it fall in a Cove out of the Stream or Current of the River, and be not driven away by it, the Sand of Stone will be beat till the Water carry it off, and the Knots and Grains of Gold, and perhaps the Dust, will remain there; and if it be deep, may be taken up by Dridges, if shallow, by any means, and tried by washing or budling, or perhaps, when dry, by winnowing there; if such a Cataract fall only after great Rains, and upon a Place that is dry at other Times; it may be more easily searched; if it be found that great Rains bring Dust to such Places, perhaps the Rain-water, or Rivulets, may be damm'd, and let go in great Quantity at once, and thereby carry down greater Quantities of Dust, or larger Knots or Grains; if any be found,

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it will be an Inducement to search the Bottom of the Rivulet, or Trough, it comes down.

Where the Shoads of Gold are chiefly found in Grains, or Dust, it may be worth while to search the Beds of Sand, which are formed by the Streams in Eddies, or Turns, so as the lightest Sand will go off, and the heavier Grains remain.

If the Gold be found in Plates, dropped as aforesaid, or beat out of the Spar, or in Dust; and as it was left by the Shoad, and not separated since, unless all the Stone was beat to Sand, and the Sand and Powder of the Spar were mostly driven away, it is impossible it can be found at any great Distance from the Vein, so near together as to bejworth searching for, except it have been formed in the Vein in as great Quantity as our baser Metals are here, and even then, the Veins will be easy to find, and it will be cheaper got out of them.

Where the Gold is found in Fragments of Spar, or other Matter formed in Veins, which is hard, and has endured the Jumble, or where the sides of the Veins were soft, and beat to Sand, and left the Fragments of Spar, &c. alone, or in Sand or Sludge; it may prove worth while to search the

the Bottoms of the Troughs, or Rivers, at a considerable Distance; the most likely Places are where any Stops were made before the Water passed, at a narrow Place, or where the Shelf remains a little higher than it is behind, and there is a little Hollow in it's Surface filled up, or where there is any Ridge of Rocks cross the River, or at it's Mouth, which forms a Bar, or where Sand, brought by Tides, or stopp'd by them, has formed a Bar since; or in the flat dry Ground, at the Point of an Angle, or Bend, where the Current of the Stream has been stopped by a hard Part in the Shelf, and after took it's Channel on one Side in another Line. Though I say the Bottoms of Troughs, or Rivers, I only mean below, where the Water would, or does run; for they are not to expect to find the Fragments of Spat with Gold in them, or the heaviest Matter always at the Bottom of the Rubble, or next the Shelf, but as the Water happened to bring it in Course, first or second, or &c. or as it happened to ledge, sometimes soft at Bottom, and hard and heavy at Top; nor are they to expect to find the Knots, or Dust left in Shoals by the Flood always in heavy Matter, or the hardest, but sometimes also above, or mixed

mixed in soft or light Matter, according to the Orders I have described above, otherwise than they will find the Dust and Sand which has been washed down in small Quantities, and separated by Water since, which may be found together, and otherwise, than the Dust which has been brought by Floods from great Rains which have torn the Mountains Sides, which will be found in Confusion. I believe it will not be possible to distinguish which holds Dust by the Eye, so they must try every Sort.

As there are some few Instances, that Grains of other Ores, or Metals, are found in the Edges of the Strata by the Sides of the Veins, they ought to examine the Fragments of Stone, which are found with the Shoads, and particularly those Parts which shew any different Texture, Colour, or Complexion, by stamping a little of each, and washing it; or if the Stone be of the Lime-stone Kind, or of any of those Sorts which will dissolve after burning, it may be tried that Way, or dissolved by boiling, or such other Methods as are found most practicable to prove, if there be any Grains of Gold, and to get them out; and perhaps some Sorts of Spar may calcine, and then that may be the

the best Method to get the Grains out of them.

Supposing a Shoad found, if there be any Fragments of Strata of Stone found with the Shoad of Metal, and that they lie in a Train, one Side naked, the other in the Surface of the Rubble, down from the Mountain thither, they may point from whence the Metal came, but must not much be depended upon, because they may be brought further than the Vein, or may be Parts of Strata which laid above the Vein, and are all broke and borne off; and if they attempt to find what Strata they came from, by comparing the Sorts of Stone, they must break into them both; because the Water, or Mineral Matter in it, changed the Colour of the Surfaces of Fragments of Stone, and likewise the Surfaces of the Ends of the Strata next the Veins, and next the Threads and Cracks, to a Depth of three or four Inches in some Stone; and more or less, as the Stone was softer or harder, even the Surfaces of the Fragments of Ore are changed, and differ in Appearance from their inner Parts; and those Fragments of Stone, or Ore, which lie near the Surface, and were broken in coming, or rounded and smoothed, have suffered some Alteration in those

new Surfaces, by Water, or Weather
since.

When they attempt to trace a Shoad from a Dale, or Gill, or Trough, they are always to observe, how the Place is situated, if the Trough, or Gill, or Dale, be the uppermost, or next the Ridge of the Mountain, where the Water divided, and took it's Course, part down that Trough or Gill, and part down another, if they find a Shoad near the Top of the Trough or Gill, 'tis very likely that it is the Shoad of one Vein, and the Vein is to be found above it, either in the Line, the Trough, or Gill, makes towards the Ridge, or in one of the sides, or brows of the Trough or Gill, between the Middle or Stream of the Trough or Gill, and the highest Ground which runs parallel side-ways to the Middle or Stream of the Trough or Gill, where the Water on each side divided, and Part on each side took it's Course down that Trough or Gill, and Part on each side took it's Course down other Troughs or Gills. If the Gill be of a considerable Length, and the Shoad be found nearer the low End, it may be a Mixture of the Shoads of several Veins; if the Shoad be found in a Dale, into which several Gills, which each several Troughs

Troughs have discharged themselves, it may be a mixture, which may have come out of the Brows of those several Troughs into the Gills, or out of the sides of those several Gills down them into the Dale, or out of the Brows or Sides of the Dale, into the Middle or Stream, as the Textures and Colours of the several Strata differ, as frequently Parts of the sides are found adhering to Masses of Ore, as the Spar is differently tinctured, by the different sorts of Minerals, or different Proportions in every Vein; and as there are different sorts of Soils, Clays, &c. mixt with the Ores of each Vein, as the Contextures of the Ore differ, and the Shoots and Figures formed in each Vein differ, where they suspect there is a mixed Shoad, and have by Part of it discovered one Vein, they may easily distinguish whether it be only the Shoad of that Vein, and especially by the Parts of the Strata adhering to the Ore, readily find what Mountain or Brow it came from.

They are likewise to observe, that in some Places, only one End, or Part of the Top of the Vein, is broke off in the lower Ground, next the Gill or Dale, and that the Remainder of the Vein is cover'd,

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or lidded by the Strata, in the upper Part of the Mountain ; and if the Brow of the Mountain be high, there may be several Ends so broke off at different Depths, and at Distances horizontally. And in these Shoals, there will be Pieces of Ribs of Spar, &c. of the whole Breadth of the Strings above the Veins, which by their Sides, are easily distinguished from Fragments, which have been broke on all Sides.

If the side of the Mountain, or Brow, the Vein stands in, and from whence the Shoad came, have but one Declination or Descent, and the Gill or Dale be nearly level, and the Vein run parallel to the Stream in the Gill or Dale, then the Shoad would be scattered all along from the Vein to the Gill or Dale, a little inclining to the low End of the Gill or Dale.

If the Vein stands parallel as aforesaid, and near the Bottom of the Brow, and the Brow be high and not very steep, 'tis likely the Top of the Vein and Shoad will lie deep, or covered with the Rubble which caine down from Part of the Brow above, or nearer the Top.

If the Vein stand parallel as aforesaid, and nearer the Top of the Brow, 'tis like-
ly

ly, the Back of the Vein will be less covered, and the Shoad will lie shallower upon a course of Rubbish, which went from that Part of the Brow lower down than the Vein, and lies between the Shoad and the Shelf.

If there be several Veins parallel as aforesaid, each of their Shoads will be found at a different Depth as aforesaid.

If there be any Stage, or Linch in the Shelf, or flat Place on the side of the Hill, or at the Bottom, not fill'd to the Line with Rubbish, the greatest Proportion of the Shoad will be found there.

If the Gill or Dale were steep, and the Water of course rapid, and the Brow of the Mountain had two Descents, there the Shoad would be driven in a Direction proportional to the two Descents, and the greater Part of it would be found near the lower Part of the Gill or Dale, and in the Orders, with respect to Depth, as aforesaid.

If the Vein make a perpendicular to the Stream of the Gill or Dale, and the Gill or Dale were nearly level, there the Shoad would lie upon the back of the Vein, or little scattered to the side next to the lower End of the Gill or Dale.

If the Gill or Dale be steep, and the Brow have but one Descent, the Shoad will be driven from the side of the Vein, next the lower End of the Gill or Dale, in proportion to the Rapidity. If the Brow have also a second Descent, in proportion to the Descent of the Gill or Dale, which is often the Case, then the Shoad will be driven towards the lower End of the Gill or Dale, in proportion to the Descent of the Brow to the Gill or Dale, and it's other Descent, towards the lower End of the Gill or Dale, and the Descent of the Gill or Dale, or Rapidity of the Water.

If the two Descents and Rapidity of the Water move each Part of the Shoad on the Brow in Lines, each making an Angle of 45 Degrees, with the Stream in the Gill or Dale; then if the Vein make the same Angle, toward the Top of the Gill or Dale, the Shoad will lie directly upon the Back of the Vein; if the Vein make an Angle of 45 Degrees, with the Stream towards the Bottom of the Gill or Dale, then the Shoad will move from it, at right Angles, and be found spread all along, from it's side to the Stream.

Thos:

Those Parts of the Shoad, which reach the Gill or Dale, would take the Course of the Water or Stream, and if there be any considerable Depth of Rubbish, 'tis likely, they will be found in it, shallower or deeper as aforesaid, and if there be several, at several Depths, and the Rubbish which came, and the Shoads if any, came from the opposite Brow, will be mixed.

Where a Vein happens near a Ridge, or Point of a Hill, there may be Shoad each way, and each will be under the Rules aforesaid.

If the Top of a Vein happened to be broke, where the Top of the Mountain is left flat, or nearly level, there much of the Shoad will lie spread near the Vein, on that side to which the Water went off, and the rest scattered down in the Course the Water took, if that Course was broad in that Breadth, if narrow in that Channel.

As soon as the Course of the Veins is found, they may easily know which is the shortest way to the Vein, as whether sideways or upward, or, &c. and without the uncertainties of finding the Shoad-stones rougher near the Vein, &c. which depends upon their hardness or softness,

R 4 that

that of the Shelf, the Degrees of Declivity, and many Accidents, the Hazard of being several Shoads, &c. and when a Vein is found, it will be easy to trace it's Shoad downward.

The antientest Practice of discovering Shoads and Veins, was by digging the Rubbish loose in the Brow of a Mountain, and collecting Rain-water, or Springs, into small Gutters or Ditches, in the Peat Moras, and thence into Dams at the top above where they so digged, and letting the Water break down at once, and wash away what they had digged, tear the other Rubble, wash the Fragments of Ore or Shoad bare, repeating it till they came to the naked Shelf, which gave them an Opportunity to discover what Shoads there were, and if any String or Vein put up to the top to see it and pursue it, which they generally did in those Parts where the Veins are lidded in, at a Mouth like a Burrow, as far as they could work it for want of Air, and then either for want of the Art of Dialling, they could not set a Shaft to hit the Forefield, or for want of Skill to bore, they could not sink for Water, or for want of good Tools, or the Art of Blasting, could not get down for Hardness, and so were forc'd to leave it,

it, and many of the Veins now in working have been begun where they left off; this hushing may be practised better, where they have great and constant Rains, or great Springs.

In Places where the Backs of the Veins put up to the Surface of the Shelf, and the Cover of the Rubble is thin, after they had found the Point the Veins usually take, where it seems they have not taken much Notice of saving the Shoad, especially in search for Veins of Lead Oar, which if alone, is so fryable, that it cannot be found in Quantity, at any great Distance from the Vein, they have digged Trenches to the Shelf in Lines, transverse the streak of the Veins, till they have discovered a Thread, or Fissure, or Vein in the Shelf, and if they have judged it hopeful, there they sunk. In some Places where the Rubbish is too deep to trench, they have sunk Holes, by any thing I can perceive, at venture, but the best way would be, to sink Holes in Lines transverse the Random of the Veins, and that would not only discover the Shoads, but if they find that the Stratum in one Hole has one Inclination, and that in the next has another, or that at the same Depth, the Strata are of different Sorts of Stone, they

they may sink between, or drive upon the Shelf, from one Hole toward the other; because there is hopes to find a Vein, where the two Sorts of Strata meet in that Line, or where each or either Side has sunk at it's Edge, and inclined or varied it's horizontal Position.

In Places where they pursue a Shoad, if the Rubbish be shallow, or the Shoad so shallow, or a little Depth in the Rubbish, they cut Holes, if deep, sink Shafts to the Shoad, or to the Shelf, at proper Distances; if they miss the Shoad, they shift aside, till they find it, and so up till they find the Shoad-stones very rough or angular; if they dig above it, or overshoot it, they trench or drive upon the Shelf, to cut, or bare the Back of the Load.

In Places where they attempt, by trenching, or digging, or, &c. to discover a Shoad or Vein, if the Veins do not always rise to the Tops of that, or neighbouring Mountains, they ought to observe to what Height they do rise, and which way they run, so that they may trench in the sides of the Mountains, and cross the Ends of the Veins, at, or below the Level they expect the Tops of the Veins, though the Miners in the North

North often discover the Veins in the sides of the Brows and Gills, and often in small Strings, (the better being robb'd long ago) they still hope in pursuing them, that such will be better Veins, when they get into the Mountain at that Level, and get Cover, because they have often found them so. If they happen to find such strings in a Place, where different Strata have met, and formed the Ends of the Strata soft, so that the Vein shattered there into irregular Strings, and the Water took Advantage of it's being soft or shattered, and made a Gill or Dale there, there is hopes that those Strings will unite in the harder Part of the Strata, which is very often rising Ground; but in the inner Parts of the great Strata, where it is of like hardness, and the Veins wide, and their Tops naked, the Assent of the Ground, gives little Encouragement.

Though there be no certain Rule to know at what Distances Veins are from one another, there being in some Places several small perpendicular Strings in the Distance of a few Yards, in some Places one, two, three, or four Veins, found upon the same Level, in the Distance of half a Mile, and others or Undersets at lower Levels, and in some Places, not one

in a Mile, where an Adit, or Level, has been driven so far across, to drain a Vein discover'd and work'd; yet in some Places where there has been great store of Ore found in a Vein, and they find any cross Strings or Threads of Ore, they drive cross, in hopes to intersect another Vein; where there is a cross String, which runs at near right Angles, to the Course of the Veins, with Ore in it, it generally communicates with a Vein at one End, or both, and is call'd a Leader; if it reaches but one Vein, one may know which way the Vein lies, by observing the Threads which fly out of it, at acute Angles the opposite way, or from the Vein, and where there are Strings, or Threads of Ore, found in the Ends of the Strata, or in the Top of the Shelf, they sometimes begin in the Brow of the Hill, and drive a Cross-cut to intersect, and so discover the Veins; if they drive in the Stratum, or Strata, the Vein stands in and far enough, they cannot possibly miss it; but generally, if they can discover any Stratum of Chiver, or matter softer than the Stratum of Stone, they choose to drive in it to save Labour. But as the Masses in the Strata of Clay, Chiver, and such like soft Beds, are liable to be press'd downward,

ward and flatten'd, and thereby the Stratum thinn'd more than the Masses of Stone, and the Strata they compos'd could, and consequently the Corpuscles of Ore which were in them, could not issue out, nor they contract so much Sideways, as the Strata of Stone above and below did, they also discontinued the Crack in the Stratum below, which would have gone strait up, or in a Line, if the Stratum below and that above had been one, as a Division between two Strata, which lay close one upon another, and very little Clay, &c. between sometimes did, more especially where the Fissure inclin'd, and occasioned the breaking of the Stratum above, at some horizontal Distance from that in the Stratum below, and in some Places we find the Chiver Bed at the Bottom of a Vein crack'd into an infinite Number of small Threads, and shattered, and those Threads in some Places fill'd with Ore, in others with Spar; and that Part of the Stratum of Chiver underneath whole, and so from the Top of a Vein, in the Stratum below, the Threads on the underside, and the Part of the Chiver above whole, which I think were form'd by the Strata of Stone which broke, and contracted above and below, and drew
the

the Chiver with them, more than by any Disposition of contracting in itself, and thole Cracks, or Threads in the Chiver, will shew by their being wider above or below the Bed, whether the Stratum which broke and contracted, and drew the Parts of the Chiver next it, be above or below, and if there be a Vein above and another below the Chiver, and near one another, the Cracks or Threads in the Chiver, will be hading or inclining from the Bottom of one Vein to the Top of the other. And where the Water broke through the Chiver Bed, and made a Swallow that will direct to an Underset; if the Bed be tough Clay, perhaps there will be few Cracks in it, or none at all.

If the Stratum of Chiver be much thicker than a drift's Height, as the Cracks from below or above often do not reach through, and in some Places are few, and very small, they may drive over or under the Cracks, above or below, and miss one or the other, or between, and miss both; so they cannot be certain of finding a Vein, unless they drive close to, or rather into, the Bottom of the Stratum of Stone above, and the Top of the Stratum of Stone below. Besides that the Veins from

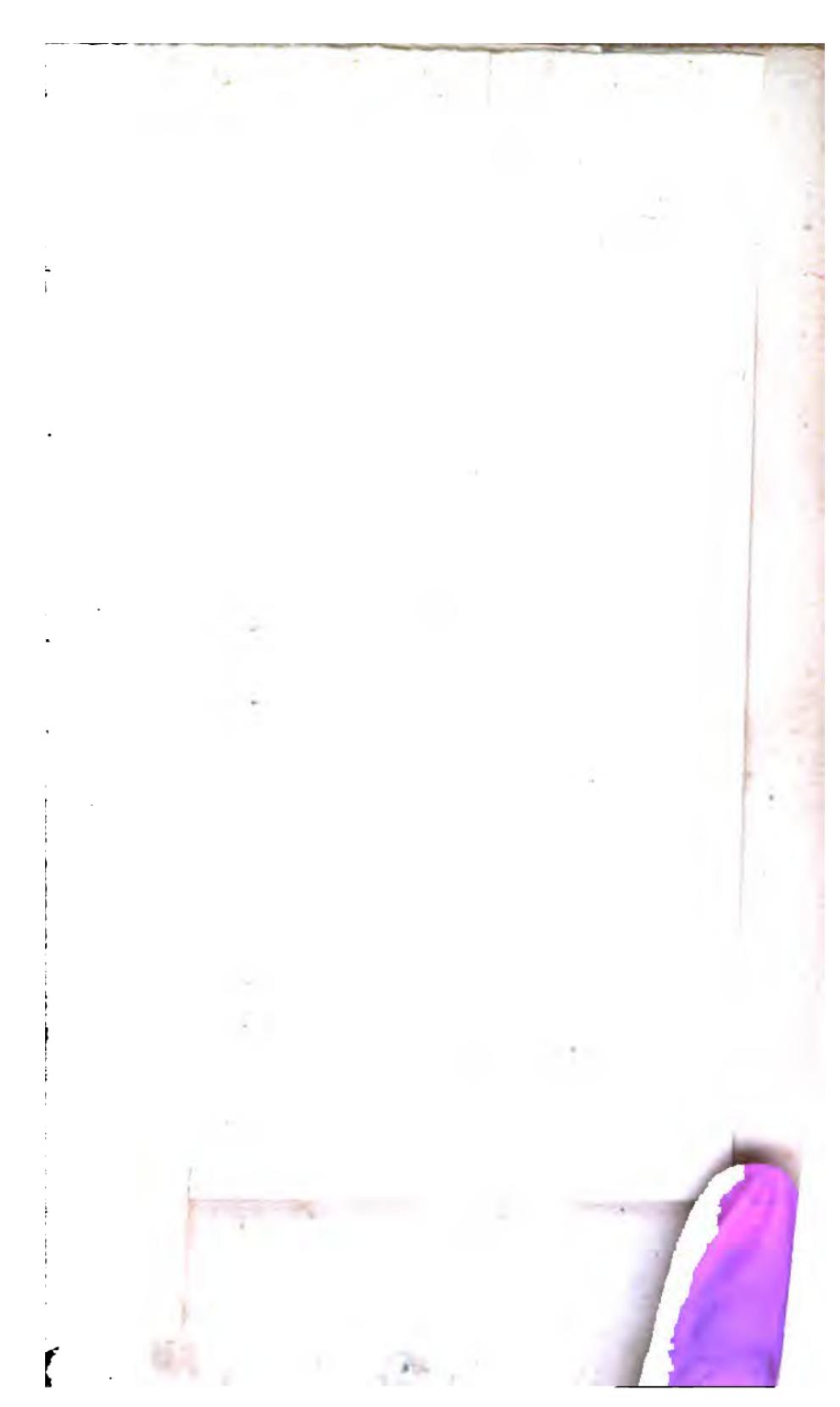
from below do not always reach in full Breadth to the Chiver, but in some Places, in small Threads, where they drive cross the Range of the Veins, in a Cross-bar, or Course-bar, if they keep not close to one or both sides; they may miss the Ends of the Veins, if they drive cross in a Stratum of Stone, that Stratum may prove to be a Lid to a Vein, and so they may over-run the Vein. In that Case, if they meet with several small Threads near together, it may be the likelier way to sink; if they happen for softness to drive across, where the Ends of the Strata of different sorts meet, they may miss the Ends of the Veins, in the different Strata on each Hand, and meet with nothing but Confusion.

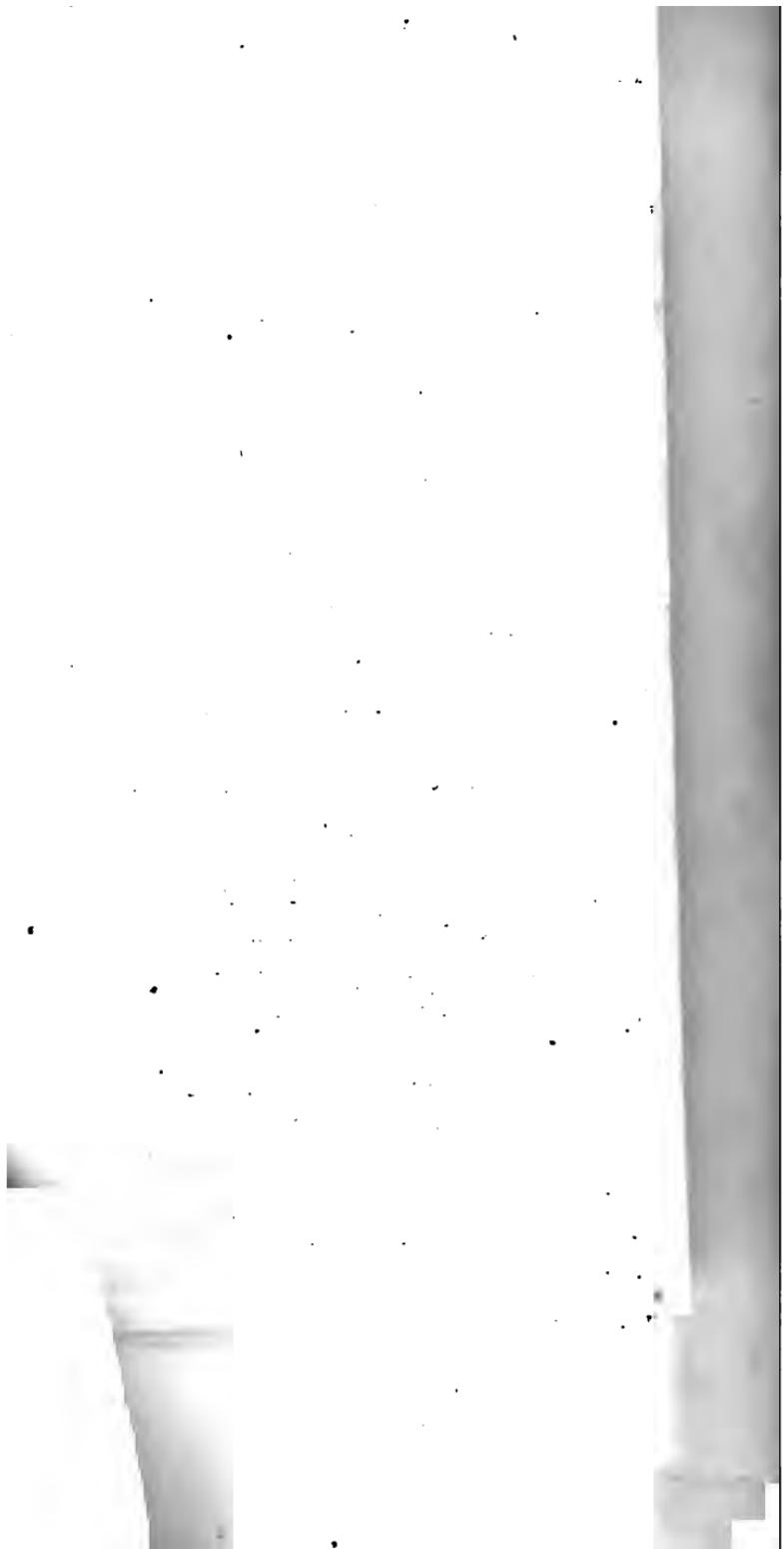
When a Vein is discover'd, they should endeavour to know on what side of the Vein the Water is, at what Depth it stands or comes in, and great Care should be taken, that they do not cut the Water, and let it into the Vein, or if there be Water in the Vein, and a Swallow found that lets off the Water, great Care should be taken, that no Sludge be let go in to stop it.

Though there be many Accidents, of which any one may lose a small Vein, there

there is scarce any one but a Cross, or Course-bar, that can lose a wide one.

Where a Cross-bar, or Fissure, intersects the Strata, in which the Vein or Load is formed, and the Vein or Load at nearly right Angles, and a new Vein, or Rib of Spar is formed, passing whole thro' the Ore, in the Vein, or Load, and neither Side sinks, it causes little or no Alteration; or if one of it's Sides, with one End of the Vein or Load sinks, if the Vein be near perpendicular, it makes little or no Difficulty in pursuing the Vein; if it be a hading Vein, or Load, it removes one End of the Load sideways from the other, in Proportion to the hading of the Load, and the Depth the one End sunk, and creates a Difficulty to know whether they shall drive to one Side or the other, or sink, or rise to find the other End of the Vein, or Load; if so, there remains no other Difficulty, but in knowing which End of the Stratum and Vein, or Load, sunk; where the Ends of the thin Strata on one Side a Fissure have sunk, as all or most of them differ in Thickness, Texture, Constitution, Colour, or, &c. it is visible by the Exchanges, as they call them, most evidently in





in Cliffs, where there are Seams of Coal, Beds of Chiver, or, &c. and also by comparing the Edges in the Mines, which End has sunk, and how far it has sunk ; but in one thick Stratum, there are no Exchanges to be seen, and that must be determined by other Rules. It is easy to represent one of these Accidents in every Part, by intersecting a Solid, and shifting it's Parts : But not so on Plains, as appears, *by the Draught annexed.*

It would make a Volume to describe the Accidents each Sort of Veins are liable to, the Manner of working proper in each Sort, of washing or separating each Sort of Ore, and the Metal in each Sort. As soon as a Description can be had of the Situation of the Places, what they meet with, what Appearances there are, &c. it will be more easy to give them Directions peculiarly adapted to the Circumstances of all their several Cases, than it is now to give Directions for every Case that can possibly happen.

It is impossible to know what Degrees they will have of Heat, or Cold, or Air, in the Mines, in that Part of *Africa*, because that does not altogether depend upon the Heat of the Climate ; the greatest Danger will be Scarcity of Air, in sinking,

or driving before a Shaft or Drift have Communication with another, to make Thorough-fare, or Circulation for the Air. In such Case, if the common Shifts of double Shafts, Air-Trunks, Bellows, &c. will not do, there may be Pipes of Latton, or Leather, or any thing of which they can be made, close one End at the Bottom, or Fore-field, and the other fixed to a close Stove, or Air Furnace, with a Flue set at the Mouth of the Shaft, or Drift, or other proper Place, and a small Fire in it, circulate the Air as much as they can need. And I hope, when the Miners have discovered a Vein, and got under-ground, and have Shafts and Drifts to circulate the Air, it will be more eligible to live in them than above-ground, perhaps more eligible than to work in our Mines; and if so, the Natives may be kept there, and obliged to do all the laborious Work.

O B S E R.



OBSERVATIONS made by J. H. mostly in the Year 1706.

I Neither saw, nor could learn, No Float,
upon Enquiry, that there was ^{nor Belly} of Ore in
either Pipe, Float, or Belly of ^{of} Cornwall:
Ore in Cornwall, only at and only
there was a small Pipe-work.

The Stone of Cornwall is in a vast Body: and there is very little Appearance of Divisions of it into Strata, or of horizontal Fissures: 'Tis probable I might have seen more, but I can recollect only one horizontal Fissure, which was at Godolphin-Ball; where the Stone above the Fissure is of Constitution different from that below. As far as I could observe, the Fissure was near horizontal.

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The Tin-Ore is only found in the perpendicularly Fissures, which they call Loads. Some of these are really perpendicular: but the greater Part are inclining, commonly to an Angle of about 20 Degrees, and sometimes to 40, say to 60; so that these come near a flat or horizontal Position.

These Fissures, in Cornwall, are generally full; and there are not in them Veins of Ore, or Eunities so frequent as in the Lead-Mines Spar; without Clay, or Rubble. in the North. Nor is there so much Clay, or other Rubble, found in those of the West, as in those of the North. Indeed I have rarely met with any more Clay in them than only so much as to colour and foul the Tin-Ore. The Veins, wherever they occur, are generally filled with Ore, or with Spar. The Ore, and Spar, in some Veins, are so promiscuously incorporated, as to shew that they both came in at the same Time. Spar is rarely found here, in these main Veins, in any considerable Quantity, pure, white, and transparent, as in the North: but is commonly mix'd or ting'd with some Metal or Mineral. But Sulphur is more frequently, and in greater Quantity in these Veins. They call it Mundick: and some of it holds a considerable Quantity of Copper.

Of Sulphur, and Mundick.
This found both sep-

Copper. In some Veins the Tin-Ore is rarely : incorporated in the same Mass with the ^{and toge-}_{ther with} Mundick : in others, they lye more dis-^{the Tin}_{Ore.} tinct ; so that the Miners find at one Depth chiefly Mundick, at another Tin-Ore. In some Veins they find only Mundick : in others only Tin-Ore.

The Veins, which are here called The D- Loads, are of all Diameters from under ^{dimensions} of the an Inch, to 10 or 12 Foot. The largest Loads, or are those of *Poldice*, *Polgooth*, and ^{metallick}_{Veins.} In Mr *Pollard's Work*. The Miners never ^{the Moun-} find the Bottom of any of these Veins ; ^{tains they} and the Top puts forth ever to the Day ; ^{sometimes} ^{put up to-} excepting that they are there usually co-^{day : In} vered with Rubble and Fragments, that ^{the Vallies} appear to have been cast upon the Veins ^{they are} by the Hurry of Water. For the Veins ^{with Rub-} of the Vallies or lower Grounds are thus ^{ble.} cover'd, sometimes to a considerable Depth. Whereas the Veins upon the Tops of Mountains are frequently naked, and the Ore exposed to the Day.

The original exterior Surface of the Earth in *Cornwall* is now wanting and ^{The ori-} gone ; being carried off by the Water of *Cornwall* ^{ginal Sur-} the Deluge at it's Departure. For which ^{face of} Reason that County is generally stony, ^{bore off,} and barren : and shews very little Soil or ^{to a great} ^{the Water} Earth, From the present State of Things ^{of the De-} ^{here}

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its Departure 'tis not possible to determine wha-
ture. Part of the Country was rais'd, or where
there were Eminences, originally, and
upon the first Disruption. For the Water
falling towards the Apertures of the Abyss,
in such vast Quantity as was then upon
the Surface, and with great Force would
bear away with it even Mountains, and
all Matter, and Bodies, that were not
firm enough to resist and withstand it.
'Twould also plow, as it were, and wear
into the Earth, and so make Channels,
chiefly where the Torrent was most impetu-
ous, and the Matter softest and easiest to
give Way. The Intervals betwixt those
Channels, by that Means, would be ren-
dered Eminences, and become Hills. The
Course of the Torrents would be deter-
min'd, partly by the Site of the Aper-
tures of the Abyss, to which the Water
tended, in order to get in: and partly
by the Constitution of the Soil, hard,
and resisting, or soft and yielding.

Countries at Distance from the Sea shew
less of this Ravage. What subsided origi-
nally from the Water there, retains more
of it's first State, and has undergone less
Transposition or Alteration. Not but
that the Water there moving in some
Places with greater Force, according to
than in

the various Course it took ; and the various Disposition of the Surface, in some Places, there would be in Course greater Alterations than in others. But the greatest must needs be near the Sea, where the Apertures into the Abyss are ; and whether the Water manifestly tended. There must of Necessity be a greater Action of the Water upon the Parts near the Sea than upon those remote, not only upon the Account of the greater Declivity, for the Land must be rais'd, the Channel of the Sea depress'd, and Apertures into the Abyss made, before ever the Water could begin to move off : but because there was a greater Quantity of Water passed here ; even that which cover'd and drown'd the Mediterranean Parts, must, as well as the rest, pass over, and act upon the Maritime.

Now Cornwall is no other than a large Promontory jetting into the Sea : and the most midland Parts are at no great Distance from it. So that it is the less strange that this County should be wholly stripp'd and divest'd of it's original Surface ; and that too to a great Depth, as indeed it appears to have been. In Northamptonshire, Oxfordshire, and other midland Counties, the Strata of Stone, near the Surface, are commonly very thin, and those

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those deeper gradually thicker, till at length they come to a great Thickness. Whereas in *Cornwall* there are no thin Strata found.

Vast Masses of Stone lying loose on the Tops of the Hills: Upon the Tops of the highest Mountains in *Cornwall*, as in Part of *Devonshire*, *Yorkshire*, and elsewhere, there are frequently found large Lumps and Masses of hard Stone of two or three Tuns, or more in Weight. These are commonly of a quite different Nature, Colour, and Constitution, from the Strata of the Stone of the Mountain underneath: and, in the Interval, betwixt these Mountains and the Sea, are found also Pieces of Stone of like Kind with these Masses of Stone above, all along quite down to the Sea. There are Instances of like Kind where there are no very high Mountains.

Instance in Cornwall, Devonshire, Yorkshire. Upon *Marlborough-Downs* are Masses of a grey Stone, vastly hard, from the Bulk of a Hundred Weight to three or four Tun. They begin at the Ridge of those Downs; which is the greatest Eminence betwixt the two opposite Seas: and tend, in a Train, Southwards. I have observed them for two or three Miles: and am told that they are continued, in a Train, Southwards, quite on to the English Channel. I am also inform'd, that there are of the same Stone on the other Side of the Ridge, tending towards

towards the *Bristol Channel*. That is the Course that the Rivers, rising near this Ridge, take each Way to these two Seas. Near the Ridge of the Hill these Stones ly thin : but, as the Distance increases, Chiefly they lie thicker, and closer ; attending the Valley, which is small, strait, and bound-ed all along on each Side by higher Ground, in such Method and Course as Water would naturally take falling that Way. There is no Stone found entire, and lying in Strata thereabouts. The nearest, that I could hear of, was at *Swindon* ; which is 7 or 8 Miles off : besides the Stratum, there, is of a different Kind of Stone : and not above a Foot in Thickness. But Stope is so scarce therabout, that the greatest Part of what is used there is fetched above twenty Miles. In all this Country, and particularly the Parts near these Stones, in sinking Wells, and dig-ging upon other Occasions, they come to Chalk immediately.

On the Hills they find Chalk just under the Turf : and in the Valleys generally within a few Feet of the Surface, there being nothing but Rubble and Earth above. They come to no Bottom of the Chalk, though they sink Wells to 40 Fa-thoms in Depth. There are several other like

Chalk un-
derneath :
and little
or no
Stone.

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like Trains of Stone in this County, but none that I know of so considerable as this. I observ'd, near one of these, at *Weekdown*, a Well sunk all the Way in Chalk, except only a Foot or two of Earth at Top.

So that these Masses must have been brought from elsewhere. Consequently, this Stone must either have lain formerly above the Chalk, which is very improbable; or else must have been brought from elsewhere.

"Tis not to be thought the Force of the Water retreating at the End of the Deluge, was so great as to break Strata of Stone, that were firm, solid, and continuous. But the greatest Part of the Strata of Stone are, and indeed were before the Water retired, crack'd, and shatter'd. Now 'twas not difficult for the Water to separate, and bear away the Pieces of the thus shatter'd and broken Strata.

Oftentimes the harder the Stone the more frequent and thick the Cracks are in it. Chirt is of the Nature of Flint or Agate; and is the hardest Stone we have in Strata. Now the Strata of this are found with so frequent Cracks, that 'tis rare to find a Piece of it above 3 Inches over; even Flints in some Places are found, amongst Gravel, crack'd; so that the Pieces separate, and fall asunder very easily:

easily: and this, sometimes, when a vast thick Stratum below is solid, continuous, and has few Cracks: Yea, when the Stratum above also is as little crack'd.

Consequently the Cracks, in that middle ^{The} Stratum, could neither be made by an Agent above, nor below: but must proceed from a Cause existent in the Stratum itself. Now I think, none here can be assign'd but the shrinking up of the Stratum horizontally; so that some Parts of it come closer and nearer together: and others separated and become distant; so that Cracks were form'd. I can think of none so likely a Cause of this shrinking, as the withdrawing the Particles of the Water that might be originally reposed amongst the Sand, or other constituent Matter of the Strata: and afterwards born thence by the Agency of the subterranean Heat. 'Tis common to see a Stratum of Coal, crack'd very thick; and frequently, tho' the Stratum of Stone above, and that below, have very few Cracks in it. The more thick and numerous the Cracks are, the less in Course they must be: And on the contrary, the fewer of those Cracks, the larger they are, ordinarily; for 'tis not to be supposed, that all terrestrial Matter shrunk in equal Proportion.

The

The Ores
of Metals
and Mi-
nerals,
lodg'd in
those
Cracks,
Fissures,
or Loads,
by Water.
The Ori-
gin of the
Veins in
Marble.

The Cracks once made, the Water tending towards them would convey thither, and reposit in them such metalick, sparry, or other mineral Matter, as it happened to bear along with it out of the Interstices of those, or the other Strata. Hence proceed the Veins in some Sorts of Marble, and in Stone : as also those mineral and metallick Veins which were form'd before the Water went off. For there are some Things observable, in Cornwall, and elsewhere, that seem to evince not only that there were such Veins or Fissures made, but some of them very large: and all usually fill'd with Spar, mineral or metallick Matter.

Of the Shoads, beginning at the Load or Shoad, lying in a Train, from the said Load, quite down to the Sea; in such Course as Water would take, by the Vales, and low Grounds, thither. There are indeed in these ordinarily Rivers: and the Shoads attend the Course of them. These Shoads are compos'd of Fragments and Pieces of Ore, Spar, or other mineral Matter, of like Sort and Constitution with that of the Load: as also of Rubble, and Fragments, ordinarily of Stone of the same Sort with that of the Strata that lie near the Load.

The Bodies found in the Shoad of the

a greater Proportion of the metallick, and ^{same Sort}
other Matter of the Vein, than of Rub-^{with those}
ble, and Fragments of the Strata. For ^{in the} Load.
the metallick Matter being more ponde-
rous, would be less apt to be driven and
wash'd away; than the stony and other
Bodies of lighter Nature. Whatever Bo-
dies are found in the Load, Tin-Ore of
one Constitution or another, Spar, or
other mineral Matter, of what Kind so-
ever, the very same are as constantly
found in the Shoad. Unless it happen
that the Tin-Ore in the Load be friable
and tender; for such would of Course be
beaten to Pieces, and dissipated by the
Water, so that it is not strange there is
none of this Sort now found in the
Shoads.

This indeed I take to be the Case of Why
the Lead of the North. For that Ore, Spar, and
being very brittle, and shattery, would ^{not Lead,} found in
be beaten to Pieces and dissipated. Tho' the Loads
Masses of Spar are very frequently lying in ^{of the}
Manner of Shoads, along the Rivers, yet
I never observ'd the least Grain of any
Lead-Ore; except at *Bouz-Gate*, near
the Smelting-Works in *Arkendale*; where
I have found Lead shatter'd just under-
neath the Turf; but the largest Grains
were not bigger than a Cherry-stone.

There

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Only one Example of a main Vein putting up to Day in Arkendale, whereas in Cumber-land, Cornwall, and Countries that lie nearer to the Sea, and consequently had their Surfaces carried off to a greater Depth, the main Veins lie open to the Day, or near it, very com-monly. There is, above; a large Vein, that is now wrought, that puts up to near the Day. That is a Thing very rare in this Country : and I know not one other Instance of it: But the Reason is plain ; this Country lies 100 Miles from the Humber-Mouth, towards which the Rivers rising here tend : and consequently the Wash and Fall of the Water departing from off the Earth, would be that Way. Here therefore, the Surface of the Earth is not skimm'd, and borne off, to that Depth as it is in Cornwall, Cumberland, and other Countries nearer to the Sea. In all these the main Veins commonly put up to the Day ; so that all the Soil, that lay originally above, to that Depth, must have been born off. Whereas in Arkendale, and other Parts of York-shire, distant from the Sea, the Miners are forced to sink 10, 20, or perhaps 30 Fathom, before they arrive at the main Vein. Not but that they meet with other lesser Veins, before, filled with Lead-Ore, Spar, or both. 'Tis from these that I imagine the Spar set forth above, lying along the Rivers was driven. 'Tis very remarkable, that that Vein in Arkendale before-mention'd, that puts up near Day, lies on the Side of a Hill, and much lower than

than the Tops of the Mountains; so that there seems to have been a greater Force of the Water there than upon the upper Parts. At about a Quarter of a Mile Distance, below, is a large, and deep Gill.

This is only a vast Furrow or *Alveus* Of the made apparently by the wearing of Water. That it is not the Result of the Inclination of the Strata is most certain. For we have wrought two Veins of Lead-Ore, in Mr. Ch. Bathurst's Estate, at Distance from each other, under, and quite cross this Gill: and we find the Strata beneath it very near horizontal. Besides, the Strata are in several Places naked at the Bottom of this, and several other Gills: and shew there the same Situation. Of these Gills I speak more elsewhere.

By the Disruption at the End of the Deluge, the first level State of the Strata was in many Parts changed. They were broken, elevated, depress'd, and variously inclined. Without that, the Water could not have got off, back to the Sea, and the Apertures of the Abyss there. And so very vast a Quantity of Water would not have retreated in some Years, had not the Apertures been very large. Nor could they have been made such, without a considerable Change of the first level Site of the Water at the End of

OBSERVATIONS

of the
Deluge.
Fissures
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Strata.

The Wa-
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of the Strata. Consequently, the first Site of these Veins, that were formed by shrinking,, and fill'd with metalick and mineral Matter, before the Water withdrew, must have their Site and Disposition changed likewise. So that those that were at first perpendicular, must, in many Places, be found at this Day inclining.

Then, the Water, falling off towards the Sea, would be determined to tear and make Havock, in one Place rather than another, by Reason of the Inequality of the Surface, consequent to the various Alteration of the Site of the Strata.

Besides, the harder Strata would make greater Resistance to the Water: and the softer less ; so that this would be more easily borne away. Of the stony, and other solid Strata, those that were crack'd and shatter'd would be more liable to yield to the Force of the Water, than those that were more firm and continuous. Again, according to the different Constitution of the Stone, the Fissures would be more, or fewer : and the large Fissures at greater or lesser Depths. Add to this, that in some Countries there was one Sort of Metal in Plenty : in others an-
other :

other : and in others little or none at all to drain into the Fissures. So that, upon the whole, the Miners Art can be reduc'd to no Rule that is certain, and will hold every-where. But in different Places, and in Strata of different Constitutions, different Methods of judging must be made use of. Not but that by all the different Information I could ever possibly procure, I cannot perceive there is any Instance of a Disposition of Ore in *Hungary, Saxony, Mexico, Ackin,* or elsewhere, of which we have not some Example in *England*. So that he that is thoroughly inform'd of the Condition of Things under Ground in this Island, is qualify'd to form a Judgment of them all round the Globe.

The Account of the Shoads given by Capt. *John Harry, Obs. of the Nat. Hist. of the Ores of Metals, p. 3, and 5. § 13, and 15,* is very right.

In the Valleys, and Places below, Of the nearer the Sea, there are found Veins, or Loads, Loads, of Ore, at different Depths ; according as there happens to be Shoads, the Valley, and other Matter, devolv'd upon them, from the Mountains above. For all that Mass of Matter which originally covered the Tracts, in which these are found,

A Corol-
lary rela-
ting to the
Art of
Mining.

OBSERVATIONS

Mountains above.

is borne off, and clear'd away. The Bodies now found lying over the Loads are of Nature different from the Loads, and the neighbouring Stone: but are of like Nature with the Matter of the Loads, and of the Mountains above. At the Bottom of one of these Shoads, in St Agnes-Liberty, the Workmen found small Lumps of Tin-Ore, very fine, and so hard as to bear a Pollish, ground, worn, and smooth'd into Form of Pebbles. I think they call them *Totty Stones*. I brought some Samples of them to Town. Were they not Tin-Grains?

Totty Stones.

A Tin-Load that stood out above the Shelf of Stone up into Rubble.

At . . . I observed a Load rising about two Foot above the Stratum of Stone in which it lay. 'Twas beset on each Side, and cover'd with Clay, Rubble, &c. I was at a Stand at first how this Ore could drain forth of that Clay. But further Observations taught me, that there were Strata of Stone, originally, which lay above that, and which have been since wash'd away; and that Clay, Rubble, &c. brought from elsewhere, by the Motion of Water, and laid in the Room of it. The Load of Metal is very hard. It seems it was so much firmer, and more entire than the Stone of the Strata was, that it resisted, and withstood,

withstood, the Force of the Water, when that Stone was borne away with it.

Those Fissures that hold Tin in the Liberty of St Agnes in Cornwall, run nearly East and West. They are intersected by other Fissures at near Right-Angles. They call these *Cross-Bars*, or *Cross-Loads*. These Cross-Loads are usually found full ; that intermost commonly with Spar ; but sometimes with an ouzy clayey Matter. I never observed any Metal in any of them. Nor did any of the Miners that I enquir'd of, pretend to have observ'd Metal in any of these, except only in one at in another Liberty. I have observ'd them of all Capacities to 5 or 6 Feet in Diameter.

The Spar, or Clay, of these Fissures ever intersects, and runs in full Body through the Ore, Spar, or other Matter of the Main Loads. Consequently, these Cross-Fissures, and the Cross-Loads in them, were formed after the Main-Fissures, and Main-Loads. Sometimes the Main-Load lying on one Side the Load is sunk : and at this Day is found lower'd 6 or 7 Fathoms in Depth. This Main-Load happens to incline, or lie in a shelving Posture. For there cannot well be

sures seem to be the perpendi-
cular Fis-
surestreat-
ed of in the
N. H. E. Cross-Fissures are of that Sort, that are treated of by the Name of perpendicular Fissures in *The Natural History of the Earth*: and were formed by the Disruption that preceded the Going off of the Water at the Deluge. We see this vast thick Stratum, or Mass of Stone, is dislocated at these: and frequently sunk on one Side of the Fissure, to a considerable Depth. Tho' this is nothing, in Comparison to what happened in other Places. The Spar, and other Matter collected in these, must have been drain'd forth of the Strata, and amassed here since the Deluge. But 'tis chiefly the sinking of the Stratum on one Side the Fissure, that determines to think these Cross-Fissures made by the Disruption. Tho' some of them being large, and all the Matter from the original Surface, quite down to the present, cleared, and borne off, by the Force of the Water returning to the Abyss, 'tis hardly accountable how these Fissures, being expos'd and open, escaped being filled with Earth, Rubble, and the like.

Query. Are there no Shoals from these Cross-Loads? For, if there be, these, though formed after the Main-Loads, were

were yet formed before the Water went off.

But 'tis certain, that the Load or Mass of Ore and Spar in the Main-Fissures, was collected before ever the Water was drawn off. That it was collected before that in the Cross-Fissures, is evident from the Vein of Spar of those Fissures crossing, and being continued through the Main-Load intire, and without any Interruption. That the Main-Load was amass'd and form'd before the Water withdrew is plain, the Load coming up in full Body To-day : and from the Shoad, which consists as well of Pieces of Ore and Spar, manifestly of the same Kind with that which composes the Load, as of Fragments of Stone of the same Kind with that which composes the Sides, or adjacent Strata.

'Tis therefore certain, that these main Veins, and the Loads in them were existent before the Departure of the Water. The only Question that can arise, is, When they were form'd? Whether at the Creation: In the Interval betwixt that and the Deluge? Or, during the Time of the Deluge? That the Load was repositored there, and form'd, by Means of Water, is certain, from the Condition and

OBSERVATIONS

Constitution of it. Part of the Ore is shot into Angular Figures, known by the Name of *Tin-Grains*. Spar is very commonly found shot in like Manner. Mundick is also found variously figured ; and the Sprig Crystal is not uncommon.

In the midst of the very Masses of Ore Hollows are common : and frequently lined and beset with crystalliz'd Spar. The Pieces of Ore in the Shoals are frequently fram'd shot : and the Spar crystalliz'd, On the Sides of the Main-Fissures there is Spar incrusted, with Plates hanging downward : and in such Manner as it is ordinarily wrought by Water, in the common perpendicular Fissures. 'Tis true, this may have been form'd since, and even to this Day, by Water that comes in freely, and in great Plenty. There might have been some Additions since ; but the main of the Load was there before the Departure of the Water at the Deluge. That the Load was compiled by Water is certain : and that this was not done before the Water of the Deluge came forth is as certain,

The stone, in which the Load is, divided Tho' the Loads lie in Stone that was originally at great Depth : and consequently, the Strata must be, in Course, very thick ; so that the horizontal Partitions would occur

cur rarely, and be seldom met with, in Comparison of what they are, where the Strata are thinner; yet these horizontal Partitions are met with here in Cornwall, as well as in other Countries: and the Stone, in which these Main-Loads lie, both here, and elsewhere, is divided into Strata.

These are apparently the Sediment of a Fluid, and the Work of Water. Nor is there any other Time assignable, in which such Sediments could have been compil'd, but at the Deluge.

But what fixes the Thing, and puts it out of all Doubt, is, that there are found Shells, and other marine Bodies, in these very Strata. 'Tis true, those Bodies subsided very uncertainly; accord-
ing as there happened to be more or few-
er of them sustained in the Water; and
as their specifick Gravity chanced to be
greater or less. In such Tracts of the Wa-
ter where no Shells were sustained, none
are to be expected in the Strata under-
neath. Where there were only lighter
Shells, the Strata that lie deeper, and con-
sist of Matter more ponderous, can con-
tain none of them; unless it happened,
that mineral Matter of greater specifick
Gravity, entering the Shells, filled them,

or concreted, after the Manner of Nodules, to their Out-sides: and by that means increasing their Weight, threw them down to greater Depths. 'Tis observable, that this Accident did not concur here: and that there are few, if any *Nodules*, found in these Strata of *Cornwall*. I remember not that I saw so much as one. As to the mineral Matter, that thus concreted, and affixed it self to Shells, and other marine Bodies, it seems to have been of a peculiar Disposition: and some Sorts of it much more disposed to concrete than others.

Of Vegetables
found in Stone.

We have an egregious Instance of this in the Leaves of Plants, that so generally are found in the Slate that usually attends Coal. There can be no Reason why these should be found so generally there, and so rarely elsewhere; but the terrestrial, or mineral Matter, that insinuated into them: and was partly of such a Nature, as would contribute to their Preservation *, and partly so ponderous †, as to precipitate them to the great Depths, at which they are this Day found.

Of the Shells that are perished. Of their Im-
pressions.

It ought not to be pass'd over without Notice, that of the Shells which were

* Bitumen. † Sulphur, Iron; in the Cat's Heads.

origin.

originally lodg'd in such Strata, as were Of Spar
porous, lax, and could not shelter and ^{in Form} of Shells.
preserve them, few are found at this Day.

'Tis true, there are, in some Strata, where
the Shells are perish'd, and gone, *Vestigia*,
and Impressions of them yet remaining :
and even Cavities of the Form and Big-
ness of the Shells. Many like Cavities
have been since fill'd with Spar, mineral
and metallick Matter ; which ever an-
swer the Figure and Size of the Shells.

In those Sorts of Stone that are tinged Shells
red, and of other Colours, by Ocreous,^{rarely} found in
and other like Matter, that hath been ^{red Stones:} superinduced and insinuated into the Pores and why.
and Cavities since the Settlement of the
Strata, it dyes the Shells red, and gives fo
uniform a Tincture to the whole Mass,
that 'tis hard to discern in these, whether
there are, or have been any Shells, or
not. This possibly may be the Reason,
why Shells are so rarely now discovered in
these colour'd Strata, in what Country so-
ever they occur. Upon the whole, 'tis
evident why we are not to expect to
discover Shells every where : and
not even in those very Strata, where
there were originally very great Num-
bers.

In

The Shells
are seldom
found in
the Strata
wherein
the Tin-
Loads lie,
in Corn-
wall :
but they
are com-
mon in
the Strata,
in which
the Lead
Veins are
in Arken-
dale.

In the Strata in which the Tin-Loads lie in Cornwall, there are few Shells ever met with. But in the Strata, in which the metallick Loads of other Countries are found, Shells occur more frequently. Nor am I sure but great Numbers might be discover'd in Cornwall, were the Miners more curious: and indeed, were there greater Occasion there of breaking into, and examining the Strata. In sinking for Stone and for Coal, many Strata are broke into, and raised: and by that Means, greater Opportunity given of examining what they contain. That likewise is the Case of those Mines where the Metals lie deep. But in Cornwall, the Loads come up to the Day: so that there is rarely any Occasion of disturbing or breaking the Strata in which they are. In Arkendale, and other Parts in the North, the lower Strata, in which the lower Part of the Vein lies, have frequently no Shells at all in them. Whereas, the upper Strata, which the same Vein intersects, passing upwards, have frequently great Numbers of Shells in them. Nor is there any Doubt, but the upper Strata of Cornwall would have shewn them as numerous, had not those Strata been all wash'd away.

As

As there are Phænomena, shewing the Effects of the Deluge on the deeper and larger Strata, so there are others, that shew the Effects of the Agent that made the Disruption at the End of the Deluge: that made and evince, that the Force that effected that Disruption proceeded from underneath; Of many Instances that might be alledg'd of this, I shall only give one in Caldyl-Island. This Island is upon the Coast of Pembroke-shire; about half a League from the main Land. It is above two Miles in Length; and above one over. The Island is high Land almost quite round. The Cliffs, in several Places, are about 50 Fathom above Low-Water. Being steep, bare, and naked, the Strata appear very plain and discernable in several Places, on each Side the Island. Nay, at the North-East End of it there is no Turf, upon the Surface; so that the Strata are naked and uncovered: and consequently visible, and easy to be observed.

Those Strata stand erect, or Edge-ways every-where. I traced several quite ^{ta} there cross the Island. They were parallel to each other: and the same Stratum of equal Thicknes in all Parts. I carefully observed the Order and Succession of them in

The Order in the Cliffs, both on the South, and of them. on the North-side : and found them ex- From N. E. observ- actly ranged in the same Order on both. ing to S. In those Strata, that I found particular W. they Shells, Entrochi, and Coralloid Bodies, are gradu- ally thick- on one Side of the Island, I as con- er and stantly found them, in the same Strata, thicker. on the opposite Cliffs of the other side.

At the North-East End the Strata were very thin ; less than a Foot in Thickness. Moving towards the S. W. I observed them thicker still and thicker ; till, at last, I came to a vast Mass, or Stratum, of red Stone, which extended, in Thick- nes, for a Mile, or more, quite to the End of the Island. I was sorry that I did not more carefully observe whether there were any Shells to be found in this Stratum. For this was, doubtless, the Bot- tom, or lowest of these Strata, at the first Settlement, and before the Strata were thus elevated, reversed, and set Edge- ways. Consequently, in it's original hori- zontal Situation, this Stratum lay, in a Perpendicular, 2 Miles deep ; the Island being of that Length. Nay, it might have been deeper ; for Part of what was originally at Top, may be cast, or worn off. This Stratum, doubtless, answers here to

to the main Stratum, in which the Tin-Loads lie in Cornwall.

In Cumberland the Veins generally put up To-day, as they do in Cornwall. The Reason is, they lie there as near the Sea as in Cornwall: and consequently, the Water retiring towards the Sea, at the End of the Deluge, would be as precipitate, bear off as much Earth, and clear it away to as great Depth, as in Cornwall. In Arkendale, which lies much further from Sea, the Earth, Stone, &c. was not borne off to near so great a Depth. So that there we mine to a considerable Depth, before we come to the Tops of the main Veins, which lie open To-day in Cumberland and Cornwall.

The Miners antiently were wont to imitate this Way of clearing off the Earth by Water. They collected great Quantities of Rain-Water: and, breaking the Dams, let fall that Water at once, to bear off the Earth, Stone, &c. and uncover the Veins. The Miners call these Hushes. Of these there is a larger Account in the Observations about the Ores of Metals. About the Year 1702, being upon Molds, a Mountain in Arkendale, I observ'd a Cloud, blacker and deeper than I ever saw before, over Grinton-Liberty. It broke,

Of the Havock made by a great Shower at Grinton, in York-shire.

broke, tore up the plain Ground, to 5 or 6 Foot deep in several Places: and channel'd the Brows and Sides of Hills to a vastly greater Depth; bearing away Stones of many Ton Weight, and carrying some, very large, several hundred Yards, unto the Plains: bearing down several little Houses, and making great Havock. There was little Wind attended this Shower. Indeed, we seldom observe much Wind with a sudden great Fall of Rain.

The Strata, on one Side of a Valley, sometimes different from those on the other Side.

The Water of the Deluge, in its Return to the Abyss, would be apt to wear most, where the Strata were so constituted as to make least Resistance. Which would be frequently the Case in such Places where Strata, compil'd of different Matter happened to meet. And this lets us into the Reason why we sometimes find Strata of Stone, on one Side of a Valley, of different Constitution from those of the Stone on the other Side of it.

The Strata, on one Side of a Vein, sometimes different from those of the other.

When the Strata began to shrink or contract, and consequently, to crack, the Fissures would be apt to be form'd where Strata of different Constitution met. This accounts for what we sometimes observe, the Strata, on one Side of a Vein, being different from those of the other, at the same Level. This Accident indeed is not common:

common : and happens likewise as well from those from those
from a Dislocation of the Strata ; those on on the
one Side of the Vein being raised, and otherSide.
those on the other Side depreſſ'd ; of which there are Instances, both in metallick Veins, in Gills, and in the Cliffs of the Sea : If it fo fell out, that the Strata on one Side the Vein had in them Particles of Metal and Minerals, of different Kinds from those of the Strata on the other Side, the Metal of the Vein would, in Course, be different too. And in this Manner, at this Day, we ſometimes find it : A Rib, or Plate, on one Side, of one Kind of Metal, as Copper : and on the other Side, of another Kind, as Lead. Nay, where there is only one Metal in the Vein, the Rib to one Side is of one Sort of Ore : and that to the other Side of another Sort. Thus I have observ'd, on one Side a Rib of Steel-grain'd, Lead-Ore : and a Rib of Potters-Ore. on the other Side. And the same Sort of Ore is only, found on the same Side of the same Vein.

Where the Strata of different Kinds met, and parted, as above : and those on one Side of the Partition happened to be of a ſolid and firm, but those on the other, in firm, of a looſer and softer Stone, the Matter in

other Side, in the Vein varies usually in like Manner; in soft Matter. that to the firm Side being harder, *e. gr.* Lead-Ore in Spar: that to the softer, other Side, Lead-Ore in Lumps, in a softish, or clayey Matter.

Of the Breadth and Depth of the Northern Gills.

Where there happens to be a Ridge of Mountains passing between two opposite Seas, there are ever great Gills. These are always in Rocks: And indeed, all Mountains of considerable Height have Rock, within at least, and are frequently bare and naked. The Gills are usually deepest where the Mountains are highest. Those of the North are far deeper than those of *Cornwall*. But there are other Accidents that concur, *viz.* the Hardness, or Softness of the Stone, in which the Gill is: and the greater or lesser Declivity of the Mountain, on each Side, serving to collect the Water that form'd it. The Beginnings, of the Gills, are generally small: and near the Ridge of the Mountains. They increase, and grow larger in Width and Depth, as they fall off from the Mountains. The Increase is, in some Places, gradual and regular: in others sudden and abrupt. There are many of them that have very frequent and deep Falls. I have observ'd of these Falls to about 200 Foot deep. As to the Bigness, or Capacity

city of the Gills, they are, from 1, to 100 Fathom in Depth : and from 1, to 1, or 200 in Breadth. In some Places, the Sides of the Gills are sloping : in others very steep. The Gills, falling off from the Mountains, meet, and fall into one another, at the Distance of perhaps, a Quarter of a Mile, less, or more, to 2 or 3 Miles, from their Rise. So meeting and uniting, they form together, what is call'd in the North, a *Dale*, of lesser, or greater Extent, as fewer or more Gills happen to meet. On each Side these Dales, other Gills ordinarily fall into them from the Ridges of Mountains, that lie betwixt these and the other neighbouring parallel Dales. Proceeding towards the Sea, two or more Dales, meeting, and falling in with each other, make a still larger Opening, which is called there a *Valley* : And, proceeding on still towards the Sea, these Vallies meeting, constitute a plain and Champaign Country. Most, if not all the Gills receive Water, some from the Peat-Marshes above in the Mountains : others from Springs, and Water issuing out of the Edges of the Strata, on each Side of them. The Water, thus collected, falls down the Gills : that of one Gill meets with that of others

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in the Dales, falls in with them, and forms a Rivulet : and the Rivulets, meeting in the Vallies, form Rivers. There fall Springs, sometimes very large, out of the Sides of the Dales, and Vallies, from the Ends of the broken Strata of the Rocks, on each Side, into the Rivulets and Rivers.

Of the
Constitu-
tion of the
Shores,
and the
Sea.

Where the Ground is soft, and not rocky, there is generally a Declivity towards the Sea. Nay, the Shores, and the Bottom of the Sea decline gradually in like Manner ; and become deeper and deeper, receding from Land. Insomuch that Sailors judge of their Approach to Land, when sounding, they find the Sea less and less deep.

There are indeed in many Places in the Sea sudden Breaks to an unfathomable Depth : and Rocks standing up at Land. These are, some of them, such Bodies of Stone, as withstood the Impetuosity of the Water returning to the Abyfs : or else Fragments broke off, and hurried by it into those Places. Some of these Fragments have Veins of Metal, and Minerals, in them ; which must have been form'd before they were torn off, and cast there.

In

In *Westmorland*, and *Cumberland*, there are several Lakes, very deep : and some, said to be unfathomable. These were hollowed, emptied of the terrestrial Matter that was there; and left thus unfilled, in the Hurry of the Water going off, for want of Rubble, and Materials sufficient to fill them : The Land here, being straight, and narrow, and so, affording a less Supply of Matter for that Purpose. The Quantity of dry Land would be every-where determin'd by the Site, Number, and Capacity of the Breaches in the Sea, down to the Abyss. The Constitution of the Surface of the dry Land depended likewise much upon those Breaches.

The Constitution of the Dales, and Of the Valleys : and the Matter there, is such, as to point forth such a Hurry, and Action of the Water. There may have been Mountains, at the first, that, by the Force of the Water, were cleared quite away. From the present Mountains, down towards the Sea, in such State as they would be put into Clay, &c. by such a Hurry. Thus, in *Yorkshire*, we find Clay near the Sea : Earth higher up in the Country : Higher still, smooth'd Fragments : And, at the Foot of the

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Mountains, ragged, abrupt Fragments. In digging into this Ground we find Things lying in such Manner as they would be cast by such a Motion of Water. Now and then a Train of Sand, or Loam, or Clay, cast in Layers, but unequal in Thickness, and uncertain in Extent. In the Midst of these Layers are frequently found Fragments of Stone, sometimes of vast Bulk, to many Hundreds of Tuns. This I have observed in *Wiltshire*, and other Places, where there is no other Stone. As of Clay, and Sand, so, in other Places, I have observed vast Layers of smooth'd Stones, almost as round as Bowls. These Notices I have obtained, partly by digging, partly by Observation, of the Sides of deep Ways, and the Banks of Rivers falling through the Dales and Vallies. The *Swale* and *Teese*, rising out of high Mountains, and the Gills, and Dales, being numerous, and collecting a great Quantity of Water suddenly, are both rapid Rivers, and upon Floods, they tear away vast Tracts of Land, and so lay the Entrails of it open. 'Tis plain, that the Place, where all this is now cumulated, was before hollowed by Water : And this Earth, Clay, Sand, Stones, hurried into it afterwards,

wards, successively, by Water. Had there not been Materials to fill it again, there had been Lakes, as in *Cumberland*.

In this Earth, thus disturb'd, brought from elsewhere, and lodg'd in Vallies, and Plains, there are not Springs, regularly, as in the original Strata. Indeed, there is very rarely any Water found, without sinking quite through all this additional Earth, to the regular Strata underneath : or at least to the Level of the Sea, Lakes, or Rivers ; by which the Earth must be saturated with Water, more or less, as it happens to be laxer or closer.

I have given an Account above of the Gills form'd in flat or horizontal Strata. These are by much the most common. I do not mean, that the Strata lie any-where absolutely horizontally : but with some In-clination, tho' that be not commonly great. In some few Gills in the North, I have observ'd the Strata on the Sides, and fore the at the Bottom, with a Declination of a Fathom in five or six ; sometimes with, sometimes against the Course of the Water of the Gill. These Gills, having been form'd at the Deluge, being in all Countries, and lying now in a Manner regular, shew, that there have been no Variation of the Site of the Strata, nor Alteration

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of the Surface of the Earth, or Mountains and Vallies made, since those Gills were form'd. From these Gills also we learn, that some Strata were depress'd, and their Site altered before the Water went off. In the North, in *Arkendale*, and many other Places, in *Cornwall*, and in *Devonshire*, upon *Dartmoor*; and indeed most of the high Hills that I have been upon, where the Stone is firm, and not apt to shatter, there lie, besides those on the Sides, upon the Ridges, and Tops, separate Masses of Stone, that appear to be rounded and smooth'd, some more, some less, in such Manner as Stones have been wont, that have been moved, shuffled, and tumbled about by the Water. They lie usually separate, and straggling: and are of various Sizes, from the Bigness of a Melon to an Hundred Weight. Nay,

Smoothed Stones,
upon the
Tops of
very high
Hills, a
Proof that
there was
once
Ground
higher.

I have observed some of several Tuns, Such Stones being frequently found upon, or near the Tops of Hills, that are now higher than any in the Neighbourhood, afford us a Proof, that there was once Ground adjoining, as high, or higher, than these Hills, from whence those Masses were borne and roll'd. That Ground being since removed, and borne away, gives us an Intimation, that the

Current

Current set different Ways at different Times. Consequently, there might be different Shoals cast from the same Vein or Load : and a Shoad on one Side of a Hill, may proceed from a Load on the other. This seems to prove, that the Abyss was not broke up, or the Fissures made in the Shell of Earth about it, all at once : but successively, and at different Times, one after another. 'Twas not needful that the Time should be great : a few Minutes would do. Thus upon the Ridges betwixt *Yorkshire* and *Westmorland*, that run near North and South, if it be suppos'd that the Breach was first made in the East Sea, the Current and Drift of the Stream would be first to East : and so might bring Fragments of Stone from Land, that lay to the West. Which Land might be borne sheer off, by a Stream running afterwards Westward, deriv'd that Way by a Breach made in the Western Sea ; by which Means a Ridge would be formed, which otherwise would have been only a Tract of plain Land Westward, with a Breast or Declension to the East. As it is, there are not only such Stones lying at the Top of the Ridge : but cast off, in Manner of Shoals, on each Side, both to East and West.

There are likewise Gills on each Side, Dales, and Vallies: as also Springs, uniting and forming Rivers, falling from each Side of these Ridges, and discharging themselves into the Eastern and

By the Action of being thus torne, Seams of Coal, and departing Water, Veins of Metal are discovered in the Sides Metals, of Mountains, and Gills in the naked Minerals, Edges, or Ends of the Strata. Had it not Cole, &c. uncover'd been for these Breaches, most of those Veins, and Seams, must have lain in perpetual Darkness, concealed from human View, and probably with-held from all Use. These Breaches likewise gave Rise to some Springs and Rivers: and make a Declivity on the Surface for all to move upon.

Of broken Masses of Spar upon the Tops of Hills. In those Countries where the Fissures of the Strata hold Spar chiefly: and the Spar is firm, compact, and not shattery, 'tis common to find Masses of it, not only on the Sides of Mountains, but upon the whole very Tops of them. I have observed such Masses upon the Tops of Hills in *Wales*, and elsewhere, to an Hundred Weight, borne off and upwards. As this Spar was certainly collected and form'd in Veins or Fissures, so 'tis hence evident that the Tract of Land and Stone, in which those Fissures were,

were, has been cleared off, and borne away since those Veins were formed. In this Spar sometimes I have observed Sparks and Masses of Lead. In such Veins where there was Metal mix'd with the Spar in Quantity, or where the Mass was chiefly Ore, there such is found upon the Tops and Sides of the Mountains ; which is the Case of the Shoals of *Cornwall*, and other Countries.

I have commonly observ'd, in Countries where there are Stone, and Spar, Fragments, and Masses, of each, lying in Vallies, and in Plains, to a great Distance ; even to several Miles from the Mountains ; whither they could not have tumbled, or being carried by their own Weight, but must have been borne by some external Agent, such as Water. Besides those found on the Surface, we discover others underneath, in digging, lodg'd amongst Rubble, Sand, Earth, and the like.

In those Countries, where the solid Strata consist of Stone, or other Matter, of different Kinds, lying one upon other, the Strata are usually horizontal, or a little inclining ; whether the Country be flat or mountainous. Where there are Strata of Coal interpos'd betwixt those of Stone,

Observations upon
the Site
and Dis-
position of
the Strata.

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in Pursuit of this the Country is sometimes travers'd for two Miles an End, and upwards, in all Directions ; which could not be, by Reason of the Water that ever rises when they descend to any considerable Depth, was the Inclination of the Strata much. Of others that incline more, the most that I have observ'd is rarely above one Foot in ten. I observed great Tracts of the blue slatey Stone, in *Wales*, and *Cumberland*. It stands Edge-ways, a little inclining. I have seen of it lying horizontally : but very rarely. All of it is parted by transverse Fissures, intersecting the Slate variously, but nearly at right Angles, with the Grain or Face of the Slate.

That the Water upon the Surface of the Earth was in vast Quantity, and the Sphere it constituted of very many Miles in Thickness, is evident from the great Havock is made, upon the Surface of the Earth, at it's going off. From that Havock likewise 'tis evident the Force and Motion was very rapid. That Force would be likewise increased by the great Weight of so vast a Volume of Water. 'Tis not easy to determine either the Quantity of it, or the Dimensions of the Apertures of the Abyss through which it pass'd. Moses re-

represents it as many Days in going off. That might be: and yet the Motion be very rapid. That Motion would depend much upon the Quantity of the Water: and the Capacity of those Apertures; which doubtless was different in different Places. But the Action and Motion of the Water would be greater at the Bottom, and upon the Earth. The Top, or Surface of the Water, would be more compos'd, quiet and smooth. This we may learn from Observation of Water let out an Aperture at the Bottom of a deep and large Vessel. There being ordinarily no very strong Current at the Top, or Surface of the Water, Bodies that swam, and floated there: would not be commonly hurried, and transported about as those at the Surface of the Earth were.

This would be particularly the Case of Seeds: of Herbs, Shrubs, Trees, and vegetable Bodies. These would fall with the Water: and when that was decreas'd down to the Tops of the Mountains that then were, would be left and reposited there. I mean so many of them as happened to be hovering and sustained over those Mountains. Nay, perhaps some more might be cast there in Manner of a Wreck. For, the Water falling, it's Surface

Of the
Seeds of
Plants.

face would continue long at the Tops of Mountains : but fall in a short Time from the Plains. In sinking a Foot it might uncover one, two, or three Foot on the Sides of a Mountain according as the Declivity of the Mountain happened to be greater or less. Whereas, when the Water was decreased down near the Level of the Plains, in sinking a Foot it might at once uncover a Plain of many Miles extent. Consequently, there would be as great a Quantity of the floating vegetable Bodies cast upon the Flats at the Top, or upon two or three Foot of the Sides of a Mountain, ordinarily, as over the whole Extent of such a Plain. Accordingly, at this Day, the Peat-Earth, with these vegetable Bodies in it, is thicker, and in vastly greater Quantity on the Flats, at the Top, and those on the Sides, near the Tops of Mountains, than in either the Vallies or Plains. Indeed I have seldom observ'd any considerable Quantity of Peat-Earth lower than the Middle of the Mountains : and hardly ever any near the Bottoms. I take the Reason to be, because the greatest Part of that which floated near the Mountains was spent, wrecked, and cast upon them. Indeed there are in all *Yorkshire*, and the other Northern

Northern Counties, hardly any Peat-Earth in the Vallies or Plains. All the Mofles that I have observ'd in low Grounds are no more than two. One of these is near *Helperby*, by *York*. This confists of only a few Acres : and lies in a Bottom betwixt two Hills, so situated as necessarily to have made an Eddy of the Water where the Moss lies ; by which Means it might be detained and kept there. The other is at *Godalmin*, in *Surrey*. I had not Opportunity of informing myself of the Extent of this ; but I take it to be small. It is situated much as the before-mention'd. I have not seen the Mofles in *Lincolnsire*. Whereas the Flats of most of the Mountains, which are very numerous, are covered all over with it. Then the Peat found in these is much cleaner, purer, lighter, finer, and more unctuous, than any found in Plains. Which affords an Intimation, that it was cast there when the Water was higher, and it's Surface much above the Surface of the Earth, where extraneous and terrestrial Matter would in Course intermix with the bituminous and vegetable.

What has been noted concerning the Trees, and other Bodies that floated at the Surface of the Water, lighting upon the Tops

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Of Noah's Tops of Mountains, carries some Analogy with Noah's Ark resting upon *Ararat*. What has been offered, concerning the Quiet of the Water at the Surface, and the Slowness of it's Fall from the Tops of Mountains, shews likewise, that there was no Need of a Miracle for Preservation of the Ark ; as some have fancied, who wrongly suppose the Water to have been there in great Turmoil and Agitation.

The Peat-Earth on Plains very thin. 'Tis sterl, and produces no Herbage. That Sterility caus'd by the Water of the Deluge. How the Seeds of Plants were preserved. Soil at the Bottom of Mines fer-

I have observ'd, at the Surface, or some of the higher Plains, a Skin of Earth, very thin, in some Places not exceeding one Inch, that is of a Rust Colour, and, in some Places, blackish. This I take to be much of the same Nature with some of the Peat-Earth : And in such Countries where other Fuel is scarce, they pare it off, and use it for Firing. Where this is found, hardly any Vegetable will grow, except a little Heath, or Moss, unless it be so very thin that the Roots can reach down into the better Earth underneath. On the Northern Mosses there are very few Vegetables that will grow. The Moss towards the Bottom is so unctuous that it will admit no Water into it. That above is frequently lax, light, and chaffy. Fire, set to it, in the Summer, in a very dry Season, will, in

a little Time, run on, and consume it for several Miles. The upper Sort is so quickly burnt out, that it is of little Use for Fuel: and therefore 'tis ordinarily cast away. Water easily enters into this: and therefore 'tis called the *Flow'd-Moss*. Hardly any Thing at all is seen growing upon it. Those vegetable Bodies that were then left by the Water of the Deluge, were acted upon by the mineral Matter that was then sustained along with them, so as wholly to sterilize them. All vegetable Bodies, at this Day, when rotted and destroyed, yield a very strong Manure, fertilize the Earth, and serve for the Formation and Nourishment of other like Vegetables. Whereas theo Diluvian Remains seem to yield nothing of that Sort. This, rightly considered, 'twill be hard to find how Seeds were generally preserv'd: and a new Race of Vegetables produced over the Face of the whole Earth after the Deluge; especially, if that sterilizing Property was universally diffused through the whole Body of the Water. But probably 'twas chiefly at the Surface, where the Vegetables floated. There woold be much Oyl, and unctuous Matter: and Oyls are very apt to take into them the most subtle, penetrant, and active

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active Salts. This we learn from the Halitus arising from Oyl given in Medicines into Stomachs charged with Salts and acrimonious Matter. But Corn, and Grain of all Sorts, and the greatest Part of other Seeds, sink in Water : and consequently would not be near the Surface, or in the Way of that Oyl, or those Salts. In the Hurry, at the Departure of the Water, though the greater Bodies, and a vast Quantity of Earth would be borne away ; yet, when the Water was almost run off, the Remainder, near the Surface of the Earth, would be turbid, foul, and full of Mud ; so that this, with the Seeds that happened to escape in it, would, much of it, settle down : and be left upon the Surface. Especially, when the Water came down very low, to the Level of the Plains, and Vallies ; for there it's Motion would not be very impetuous. Though the Mass of Bodies in the Peat-Earth is thus sterile, and incapable of Vegetation, almost all other terrestrial Matter whatever holds in it something, more or less, that is serviceable to Vegetation. Even the Soil, Stone, &c. dug from the Bottom of our deepest Mines, and Veins, when it comes to be exposed upon the Surface, moulder'd, and wrought upon
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by the Weather, and the Salts, if any, carried forth, bears Grass and the common Herbage pretty freely. I have seen upon Coal, Shaver, &c. flung forth, after some Time, yielding Grass moderately well. But then Allowance ought to be made for the vegetable Matter cast on it by Rain; which yet produces nothing on the Peat-Earth: so that this holds in it something destructive of Vegetation.

Tho' the Wear; made by the Water, Tracts of Mountains, and the greatest Quantity of High-Land, in Midland Countries, and at Distance from the Sea.
 and the main Quantity of terrestrial Matter removed, and borne down, would be governed greatly, and depend much upon subordinate Causes; such as the Current of Water directed to the Swallow of the Abyss: The Constitution of the Strata, in some Places firm, solid, thick, continuous, and apt to resist; in others broken, more soft and yielding: yet, *cæteris paribus*, [the Wear would would be greatest toward those Seas, that had the most, and the largest of those Swallows, and least towards Straights, Channels, and such Seas, as had few or none] the Land would be generally most depreſſ'd toward the Sea: and left highest, and more elevated, at Distance, up in the Country. This is the Case of the *Alps*, of the *Appennin*, of *Taurus*, the *Andes*,

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and other like vast Ridges in Midland Countries.

How the small Fragments of Stones came to be worn very smooth and fine.

'Tis very common to find Fragments of Strata of even the hardest Stone, as also Pebbles and Flints much worn and smoothed. This will be the less surprising, when it is considered that, this being transacted in Water, they would grind and wear the more easily. Then, besides their being shuffled, and rubbed on one another, the Bottom, on which they moved, was, not only solid and hard, but frequently craggy and rough, and so the more disposed to fret and wear them. For, in many Places, all the loose Matter appears to have been in Motion, quite down to the Strata of Stone : and even the uppermost of these were shattered, raised, and borne away, sometimes to a very great Depth. As the uppermost hard Strata gave Way, the Fragments moved upon the lower. Then there were in the several Parts vast Precipices, down which the Mass falling would be further shattered and broken.

How the Water got down into the Abyss at the End of the Deluge.

'Tis certain, from various Observations, that the Strata of Stone were chapped, cracked, and had Fissures in them, some of considerable Width, before the Water went

went off. If it be supposed, that any of those Fissures pervaded the Sphere of Earth quite down to the Abyss, some Water would enter, and fall in: and, if there was any considerable Degree of Heat there, that would rarify this Water, cause a great expansive Force and Insult upon the Sphere of Earth, make a further Disruption of it, and a Dislocation of the Strata in some Parts; so that thereupon the rest of the Water would follow, and fall down in such Quantity, as to be too much for the Heat then to rarify in any considerable Degree: and therefore, afterwards there would be no further Force exerted, or Alteration made, besides what happened by the Motion of the Water on the Surface of the Earth.

That there were Fissures: that there was metallick and mineral Matter lodg'd in them, and that the Loads were com- piled before the Water withdrew, is evident from the Trains and Shoads we at this Day find borne down from them by that Water. How those Fissures were made, I cannot conceive; unless it was by a Contraction and Shrinking of the Strata. The Sand, subsiding, would be plentifully saturated with Water: and with the metal-

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ter set forth in the next
Section.] such metallick and mineral Corpuscules as as happened to be sustained amongst, and to subside with that Sand. What was the first efficient Cause of the Cracks, and whether the Heat of the Abyss, I take not upon me to determine : any more than how so great a Quantity of Stratum, as we see frequently lying betwixt two Fissures, happen'd to shrink, retract, and hold together. But this is no Argument against such a shrinking, though the Strata were very lax and soft. We see how vast Fissures are frequently made in loose Earth in Summer. So there are commonly frequent and considerable Cracks made in the Sand of the Shores, after the Retreat of the Sea, and betwixt Side and Side. Nay, I have observed, in Strata of Sand, lying betwixt Strata of Stone, Cracks to two, four, and even six Inches in Width, where the Strata of Stone have not been crack'd at all : or at least, not with Cracks that correspond, or fall in the same Lines, with these. 'Tis not likely that these could happen by any other Means than shrinking ; though it be not easy to conceive how the Sand could hang together to make such a Contraction. I have frequently observed those Cracks in the Sand to be since filled with finer

finer Sand of a different Colour: and sometimes with other Matter. Particularly, about *Guilford* in *Surry*: and in other remoter Parts. The Strata of Chalk are frequently cracked in like Manner: and the Cracks in some Places filled with a sparry Kind of Flint. In the hardest Lime-stone I have observed Cracks, some longer, others shorter, and only of a few Inches, like those in Timber, terminating at each End in an acute Angle. When these happen to be filled with Spar they make Veins, and a Variegation of the Stone; which is the Case of much of that, call'd *Vein'd Marble*. The Cracks in the Strata, after their first Settlement, would be proportion'd to the Intenseness of the Cause, the Tenacity or Cohesion of the Matter of the Strata, the Quantity of Water with which they were saturated, and the free Reception it met with in the Cracks. An Oak, or other Tree, fell'd, will have Cracks in it, more, or fewer, wider, or straighter, in Proportion to the Quantity of Sap in it, and to the Intenseness of the Heat of the Sun. For which Reason, to hinder their shrinking and cracking, they commonly cover the newly fell'd Trees with Roughs. The Cracks commence commonly at the Heart of the

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Timber, and tend, in Rays, to the Outside. As to the Fissures of the Strata of Stone in *Cornwall*, and elsewhere, they are generally narrower or wider, as they are more or less frequent in the same Sort of Stone. For some Sorts of Stone would certainly shrink more than others, as they happened to have larger Interstices, or the Parts to be more tenacious, or the mineral Matter happened more readily to get forth. I think it may pass for a standing Rule, that where the Fissures are widest, there are the fewest of them, and the Stone is the firmest. So, where the Fissures are frequent, they are answerably small; though the Pieces of Stone, so shattered, may be very hard. From these Circumstances of the Fissures 'tis evident the Cracks were made by a Contraction; those Cracks perpetually bearing Proportion to the Quantity of Stratum contracted in Stone of the same Constitution. Some of the Fissures of *Cornwall* are near twenty Foot over, and commonly full, or near it, of metallick or mineral Matter. Now that cannot seem strange, when 'tis consider'd how large a Tract of Strata there was allotted to feed and supply those Fissures. If the Strata held in them a sufficient Quantity of loose mineral and metal-

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metallick Matter, and it could find Passage to the Fissures, they must be filled. Otherwise there would be Vacancies in the Fissures. But in some Parts there was such Quantity, that we find Strata saturated with Spar, and other Minerals, as also with various Metals, at this Day. Of Iron particularly, there are Strata found so plentifully saturated with it, that they are well worth working for it.

The Sand, of which the Strata of the Stone were form'd, and all other terrestrial Matter, settled down in Water. As each Settlement came nearer the Bottom; the Parts came nearer and nearer to one another. The Mass, at the first, would be very thin; suppose half Water, and half Sand. By Degrees, the Sand settling, the Water would rise out of it, till there was not left behind, suppose what amounted to a fourth Part of the Whole: and so on, 'till it was reduced to a less Proportion. The Water, rising out of the Settlement, would bring up with it some metallick and mineral Matter perpetually; the Corpuscles of this being finer than those of Sand: and so easily passing the Interstices of it. Thus it would happen in the several successive Settlements. If

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there were left in each but one twentieth Part Water, that would be sufficient to educe and drain forth as much metallick Matter, as we ever find in any Fissures or Loads. That Matter would be more apt to follow, because of the extreme Tenuity and Subtilty of it's Parts. Of this we have Proof from the Solutions of Metal in *Menstrug*: the Tryal of them upon a Touch-stone: The Malleableness and Ductility of some of them. A very small Proportion of Gold, covering Silver, may be drawn out, in Wire, to many Miles in Length: and yet the Whole be gilt all over. See Mr Boyle's *Essay of Effluviums*. There needs no other Proof of the Subtilty of the Parts of Copper, Iron, Lead, and Tin, than that they may be all driven away, in Form of Fume, by a strong Fire. The Fineness of the Spar, and other Minerals, found along with the Metals, in the Fissures, may be evinced by their Passage through the Pores and Interstices of the Stone into those Fissures. The great Difficulty is to find how the Settlements or Strata became cracked transversly: and Fissures made for the Reception of metallick and mineral Matter. 'Tis certain that, in all Parts, the deeper they are, and the

the nearer to the Abyss, they are the wider, and the more capacious. This seems to point to some Agent there that was the Cause of them. Nor can I think of any other than Heat or Fire. As this did drive off the Water in the Interstices, the Sands would approach closer to each other : and consequently, the Strata shrink and contract ; by which Means Fissures would be made in them. These Fissures generally bear a Proportion to the Quantity of solid Matter that lies betwixt them ; which indeed, is a good Argument, that they were caused by a proportional shrinking of that Matter : so that where they happened to be widest, they are less frequent, and numerous, than where they happened to be narrower. As the Fissure became larger and larger, the Water charged with metallick and mineral Matter would come forth into it: and as that quitted the Stratum, it gave way for a still further shrinking of that Stratum, and consequently, a further Inlargement of the Fissure. Then the more the Stratum shrank, the closer and more contiguous the Sand became ; And consequently, the more dense, firm and solid the Stone. The Stone, indeed, could not have attained any Solidity, had not

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not the Sands moved nearer each other thus in an horizontal Direction, as well as in a perpendicular. Some Consideration is likewise to be had of the metallick and mineral Matter that got forth from amongst the Sand. Where this was most in Quantity, the Shrink of the Stone would be the greatest: And consequently, the Fissure the widest. The Egress of the metallick and mineral Matter, and the Contraction of the Stone, must be gradual. Where the Fissures are widest, and the Load, or Quantity of metallick Matter in them, the greatest, there is nothing surprizing, if all Circumstances be duly attended to. For the metallick Matter in the Fissure rarely bears the Proportion, to the sandy Matter of the Stone of 1 to 500: Nay, perhaps, 1000, or more. Where there happen to be two or three Fissures near each other, there constantly a considerable Tract of Stratum intervenes before more Fissures occur. The Weight of one Stratum upon another, and of the Sphere of Water over all, would contribute something towards pressing the Water, forth of the Interstices of the Sand, into the Fissures. By this Means the Sands would be brought nearer in a Perpendicular, as by shrinking they

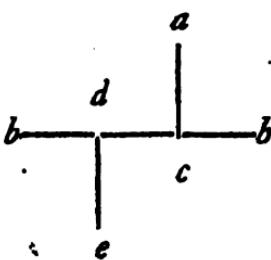
they would in an horizontal Direction : and the Strata became thinner at the same Time that they shrunk. Nor need that seem strange, of which we have an Instance before our Eyes daily in felled Timber. A Tree consists of several concave Cylinders *, one within another. As the Sap and Humidity gets forth, the Tree contracts, and lessens in Girt : And consequently, those Cylinders become thinner and thinner, as the Strata of Stone do. Nay, they become cracked and fissured transversly, in like Manner as those Strata are ; especially, if expos'd to too much Heat, and the Sap drawn off too suddenly. Nor do these Cracks constantly pass in a streight Line from the Axis towards the Surface : but, after they have passed one Cylinder, or more, they terminate against another Cylinder ; which is cracked, perhaps, at an Inch Distance, and then that Crack continued forward through the rest towards the Surface. The same is observable in charr'd Wood. So likewise a Fissure running, suppose East and West, that passes down in a Perpendicular thro' several Strata, frequently terminates, and

* These are what are commonly called the *Annual Rings*.
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abuts upon the solid Surface of a Stratum; where mining horizontally upon the Surface of that Stratum, either North, or South, at some Distance, the Miners meet with another like Fissure running on the same Point East and West. The Fissures in the same Country generally run upon much the same Point. 'Tis not easly to find out how Sands hang together so as to make a Contraction of the Stratum; Wood, being fibrous, and the Fibres having a Connection with each other, may easily contract. But we see even Metals will do so too: And the metallick Cake become less when cool after Fusion. Nay, Lead will crack; especially, if it be not perfectly refined. Even Clay will crack: and Sand itself; of which we have common Proofs upon the Retreat of the Sea, at Ebb, when the Heat and Power of the Sun is great. It has been already noted, that the Fissures at the greatest Depth are the largest: but the least, frequent: Ascending, they become gradually less, but more frequent and numerous. Insomuch that, were the Globe divided in two, and these Strata viewed in Profile, the Fissures would appear much, in Manner of a Tree; at the Bottom a large Trunk; higher this divided into great Branches;

Branches; higher still into lesser Branches; and at Top into Twigs. Of this I have given an Instance, in my Account of *Scree's-Mountain in Cumberland*. By a general Consideration of the Width of these Fissures, and their Distance in any Country; some Conjecture may be made what Quantity of the superficial Parts of the Globe there were borne off by the Water retreating. It has been already hinted, that the Veins are not continued in a Line: but start. Where the Fissure *a* approaching the Surface of the Stratum *bb* bounds at *c*: and starting from *c* to *d*, commences anew at *d*, passing then down to *e*. Such Boundaries of the Fissures as



cd would prevent the metallick and mineral Matter from falling down into the Abys. It has been noted already, that the Fissures at the greater Depths are wider, and less frequent, than those nearer to the Surface. But in what Proportion, 'tis not easy to determine, for Want of sufficient Observation. There can well be no Doubt but that there are Variations in

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in different Countries, and where the Constitution of the Stone is different. Whether the Contraction of the Stone in the same Place be commonly equal and uniform : and the Sum, or Aggregate, of the Capacities of the more numerous Fissures above, be equal to that of the larger Fissures below, Time and future Enquiries must determine. Mean while 'tis certain, that in Countries that have had the least of the Surface borne off, the lower Strata are thicker than the upper. Even in the North, where the Deteriorations of the Earth were very considerable, the Miners sink through ten, or more thinner Strata sometimes before they arrive at that vast Stratum, in which the grand Mass of Metal is lodged. In the thinner Strata above there is only lesser Veins or Strings of Ore. In mining 'tis generally observed, that as they descend the Strata are found thicker and thicker ; though I have seen some Exceptions from this Rule : and a thinner Stratum of Stone, differing both in Colour, and Substance, lying under a thicker. 'Tis likewise certain, that the lower Strata were nearer to the Abyss : and so more exposed to the Operations of such Heat as might be there. As the Matter, out of

of which the Strata were form'd, subsided, the Water continually arose, and mount'd upward. The upper Strata would be more humid, and lax than the lower. They likewise were less press'd, and had a less Weight upon them than the lower had. Lastly, Allowance ought to be made for that vast Volume, or Orb of Water that was at the Surface, and covered the Whole. 'Tis known, that nothing is more opposite to the Operations of Heat and Fire than Water is.

"Tis not to be imagin'd that the Stone Of the shrunk equally : or, that the Fissures in the Stratum were made at the same Time, but successively. Then the Matter brought unto those Fissures by the Water would bear a Proportion to the Force of that Water, or rather the Force that moved it. For while the Water had Scope to rise up, during the Subsidence, that Rise being gentle, and without any great Force, very little metallick Matter would attend it's Motion. But when, by a continual Subsidence of Matter upon any Stratum, the Water was pent up, and hindered from rising, and the upper Settlement press'd and bore upon the lower with all it's Weight, all the Matter of that lower would be under a Force ; and

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and such Parts of it as were most capable of Motion, which only the Water; and those Bodies, that it could bear with it, were, would move in an horizontal Direction, all other being barr'd, towards the Fissures, so soon as any were made for it's Reception.

Of the Shrinkage,
and the Formation of the Fissures, in
the Strata.

As the Water moved out of the Strata; they would be more capable of shrinking or Contraction. I do not here inquire into the Power that renders Bodies capable of contracting. There are Evidences sufficient of it's Existence in almost all Bodies; which is enough for my Purpose. After, by the Weight and Pressure of the upper Strata upon the lower, the Sands of these came to have their horizontal Surfaces nearly contiguous and close, the Stratum had attained nearly it's Form in that Direction. But then there would be considerable Intervals betwixt the lateral Surfaces of Sand and Sand. The perpendicular Pressure could contribute nothing to the straitning or lessening of these. That could be effected no other Way than by their moving closer to each other, in an horizontal Direction; which would cause a shrinking and Contraction of the Stone, and an Enlargement of the Fissures, in Course. If the Sands shifted;

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and approached nearer to each other by only an infinitely small Part ; suppose 500, or 1000 ; [some of our best Crops upon Hills growing only out of shattered Stones, and other Observations teach us that, besides the arenosous, there is vegetable Matter incorporated in Stone. Now, this being fibrous, may, perhaps, attribute something towards drawing the Sands nearer to each other, and so to the shrinking of the Stone.] 'twill be sufficient to make the Fissures. Upon such a Contraction of the Strata, and some Pressure continuing likewise from above, the Water would be sent from the Interstices of the Sand to the Fissures with some Force : and so would bear with it all Matter that was small enough to pass through those Interstices. But the metallick and mineral Corpuscles, being of different Sizes, after the first Running, in which the Corpuscles lying promiscuously run confusedly, the finest only would flow next : And finally, as the Sands were drawn closer together, and the Matter began to be press'd with Force, the sparry, and all the other coarser Matter would be borne forth in it's Turn ; 'till at last the Sands were brought so near together, and their Interstices so streightned, that even the

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Water it self was forced forth, or at least, so much of it as not to be sufficient to move or convey any thing. Nor was there Room left for any like Passage since in Quantity. What seems to make most for this, is, that in many Places the small Fissures and Cracks are full of Spar alone.

The lesser Fissures made after the larger. These were only lesser Shrinks, and probably made after the larger. Had they been made, and fill'd, before, I can see no Reason why they should not have held some Metal, as the larger do ; there being of these lesser Fissures so very commonly near the larger.

The Cross-Fissures formed after the Main-Fissures.

The Cross-Barrs haye rarely, if ever, any Metal in them ; though they are in the same Stone, where the main Veins are, which hold Tin, and other Metal, in great Quantity. The Spar of the Cross-Barrs intersecting, and passing in full Body through the metallick Load of the main Veins, affords us a positive Proof, that those Cross-Veins were formed since the Main-Veins.

Of a Sludge, or fine terrestrial Matter found in the Fissures.

Besides Spar, there is found, both in the Cross-Barr, and in the lesser Fissures, sometimes a Matter very soft, fine, and resembling Soap, of various Colours, chiefly red, or yellowish. Sometimes they are empty ; or at least in Places. Some-

Something like this Succession of various Matter in filling the Fissures, we see in the Expression of any Liquor that has other Matter mix'd with it. This ever flows finer and clearer at first : but afterwards, more crass and turbid. All Again of Stone whatsoever has Fissures in it ; but, ^{the Fis-}
^{ures : of} in some they are more, in others less ^{that passes} the Water frequent. Many of them intersect one another at various Angles : and by that Means part the Stone into Segments. There are other Fissures, particularly in Marble, Lime-stone, and the other ^{that carries mine-} tougher Sorts of Stone, that terminate ^{to the fides and} at one End in an Acute Angle, in the Mass of Marble or Stone ; without passing ^{neigh-} to a transverse Fissure in that ^{boiring} Direction. In other Directions they may, and frequently do ; for Water commonly passes them. Which, carrying in it a mineral Tincture, of Colour different from that of the Stone, it insinuates, and imparts that Tincture to the Stone sometimes less, sometimes more, to an Inch or two, according as the Stone happens to be more or less dense or hard.

Where the Water, thus passing, hap- By the pen'd to be free from colour'd Matter, Water and either pure, or only charged with ^{pervading} the Fis- Salts, ^{the Fis-} the

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Sides, and Salts, it sometimes takes away Part of Neigh-
bour- the colour'd Matter of the Stone, that
Stone, is is near the Fissure: and by that Means
sometimes depriv'd renders the Stone there clearer, whiter,
of its and consequently, different from the rest.
Colour.

To these two Accidents are owing
Hence the the Variegations of most Stone and Mar-
Varigati- ble. Many of the Cracks in Marble,
ons of some and the finer Stone, are so small as to be
Stone and hardly discernable, even after they are
Marble. Again, of polish'd. But they are so frequent in
the Fif- that Marble that is most variegated, that
sures: and it is much more apt to splinter, start,
the Origin of them. flaw, and shatter in working, than other
Marble.

Not but that I am inform'd, by those that work it, that Marble that is thus crack'd and variegated, in such Parts where it is free from Cracks is more dense and hard, than the white Marble that has fewer Cracks in it. If that be really so, it affords some additional Proof, that the Cracks were made by Parts of the Stone shrinking, and the Corpuscles drawing closer to each other. Indeed a Crack, that terminates in Stone, and does not pervade the whole Body acros, cannot be form'd any other Way than by a shrinking of the Stone.

No consider- Indeed, since the Mass of Stone hath
able Quantity been condens'd, and the Pores streightn-
of Water ed

ed by shrinking, though there may be at this some infinitely small Humidity in it; ^{Day passes} the Substance yet no sensible Quantity of Water can stand of now possibly pass it. In a large Baking ^{the Strata.} of Bread in an Oven of Stone, the Humidity of the Dough requires several Hours to be evapourated. And yet, after all, only a small Part is carry'd off; the Bread, when first drawn, being, except the Out-sides, near as moist as the Dough when put in. Then the Moisture that is really sent forth, or a great Part of it, passes through Cracks of the recent Clay, us'd for cementing on the Cover of the Mouth of the Oven. The Fume, or *Halitus*, comes visibly through these Cracks. If any pass through the Mortar, or Stone, of the Sides of the Oven, 'tis so little as not to be perceiv'd by the Sense. Tryal may be made by a Looking-Glass, or other specular Body. And yet they seldom use Stone of above half a Foot, or a Foot thick for the Sides. Nay, that us'd for closing the Mouth is rarely above two or three Inches thick. Beside, 'tis commonly made of a porous Stone, and such as gives freer Passage to Humidity, than Stone that is more dense and firm. Were this not porous, so as to give some Way to the

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Fire to pass, it would force and burst it. Now when such a Strength of Fire cannot pass Humidity thro' even the most porous Stone, in any sensible Quantity, 'tis not likely Water can pass of itself, and charged also with metallick and mineral Matter, thro' much closer Stone. We see Troughs, and Cisterns, with their Sides and Bottoms very thin, made even of the coarsest and loosest Stone, that yet hold Water so well as not to suffer the least Drop to pass. If Water, charged with mineral Matter, could pass the Substance of Marble and Stone equally and indifferently in all Parts, it would be tinctur'd uniformly, and not variegated, and tinged only near the Cracks, or perhaps, have these Cracks only fill'd with Spar, or other mineral Matter, as at this Day we frequently find them. Or, if the Water were pure, it would not clear them as it does, by Parts, but universally, and through the whole Mass.

Notes of Agreement betwixt the Strata, and the Masses broke from them at the

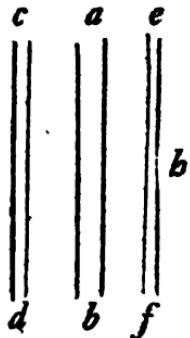
Mass. Then Fragments of Stone, however vast and bulky they might be, that were sever'd and borne off from the Strata by the departing Water at the End of the Deluge, differ from the Strata whence they were so sever'd in only a very few Respects. The Constitution, and

and all the Colours that were primary and original, I mean such as the Stone had attain'd before the Water went off, the Fragments yet retain in common with the Strata. Where the Strata are spotted, as in Porphyry, the Fragments are spotted too. Where the Strata are vein'd with Metals, with Spar, or other Minerals, the Fragments are vein'd in like Manner. Where the main Mass of the Stratum is grey, the Fragments are grey: Where that is brown, they are brown: And so of all other Colours. These Accidents being common both to the Strata and the Fragments, there can be no Doubt but they proceeded from a common Cause acting upon them conjunctly, and before they were sever'd. That each are of the same Sort of Matter, that the fundamental Colour of each is the same, that they are spotted or vein'd alike, proceeded from Accidents that befel them, as has been said, in common, and conjunctly. Then the Fragments appear to be of the same Thicknes with the Strata from whence they were torn. And In some bold Sea-shells of the same Sort, lying Places the each Species over other in the same Order Sea-shells lodg'd in and like Number. Or, if the Shells the Strata, happened to be perish'd, and gone, and the ^{In some Places the Sea-shells lodg'd in the Strata, perish'd, and the} only

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Bodies form'd in them invested with Crusts of Spar, before the Departure of the Water. only the empty Spaces left where they were originally contain'd, in the Strata, the Shells are also gone, and only such Spaces left in the Fragments likewise. Where those Spaces in the Strata are fill'd up with Spar, they are fill'd in like Manner in the Fragments. Which, by the By, affords a Proof, that those Shells were dissolv'd, and the Matter of them convey'd away: and sparry Matter re-posited in the Place of it, before the Fragments were borne off. 'Tis observable that, of the Stones, form'd in Shells, both those found upon the Sea-shores, at the Surface of the Earth, and those that are lodg'd among loose Rubble, Clay, and other shifted Earth; some are quite naked, others cover'd with a sparry Crust, in Form of the Shell. All the latter, and many of the former, were borne out of the Strata. So that these Accidents befel both, while they were together, and before the Partition. But there are some Accidents observable in the Strata, that Enquiry ought to be made, whether they are likewise in the Shoad-stones and Fragments. These are the Variegations made in the Stone by the Sides of the Cracks, made by Addition of a mineral Tincture, or by Removal.

wal of some of the Matter of the Stone, in the Manner set forth above. If these be not in the Fragments, they, and perhaps they only, are the Alterations that have befallen the Strata since the Fragments were parted from them. 'Tis probable, from a complex Consideration of all the *Pheomena*, that in the same Tract of Stone, the Fissures that hold ^{The Or,} Metal were form'd first, afterwards, those ^{der in} that hold Spar only; and finally, those ^{which the} Fissures that have only Sludge in them, or else ^{were suc-} are empty. Nothing is more common ^{cessively} made, and than to see such empty Fissures near ^{fill'd with} others that hold Metal, or Spar, or other ^{Ore, Spar,} Minerals. Such are seen not only running in other Directions, but even parallel with those Fissures. Therefore, these empty Fissures must needs have been form'd since the other were. Otherwise they must have had Metal or Spar in them, as well as the Others. 'Tis plain, Water could not convey metallick, or sparry Corpuscles from *g* towards *b*, or from *b* towards *g*, and so pass



the

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the Fissures *c d*, or *e f*, and reposit the Metal or Spar in the Fissure *a b*, only, without repositing any at all in either *c d*, or *e f*, as it pass'd thro' them. It would be much more likely to reposit it in either of them, than in *a b*. Were it so that Water pass'd at this Day incessantly, charged with metallick, sparry, and other Matter, through the Pores of the Strata, such empty Fissures could not be there found. It must fill them, wherever it were so charged with such Matter. The Sludge, Soyle, or other Clayey Matter, mov'd into the Fissures last of all, and got as well into those that held Metal and Spar, as into those that were empty. These being form'd last, and it being found in them, affords us a Proof, that it mov'd the last. Doubtless the very small fine Cracks in Marble and Stones were made last, and after all the rest. After what has been said of the present Density of the Stone, and how

The Water that supplies Springs pervades the Fissures only, and not the Substance of the Strata.

impervious it is, we must conclude, that the Water rising from beneath for supply of Springs, Rivers, and Rain, pervades not the Substance of the Strata; but the Fissures. 'Tis plain, it will take those Passages that are most open and pervious.

In

In Blasting, Gunpowder confin'd in a bored Hole, where the Rocks happen to be shatter'd, and full of Cracks, often-times so small and fine, that they are imperceptible, will, when fired, find it's Way thorough those Cracks, without making any Insult, having any forcible Effect, or answering the End for which it was used. 'Tis hardly credible how great a Quantity of Water will sometimes be flung upon the Miners, when they come to break up Strata of Stone, that have in them many of these Cracks, that are so small that they are hardly discernable. These are indeed the natural Conveyances of Water: And, when once they are opened, it runs incessantly. I have observ'd such an Irruption of Water in vast Quantity in Stone, that, exempting those Cracks, is much too dense and close to let any the least Humidity pass. There are Fissures, at this Day, found full of Metal, that are dry, and without any Efflux of so much as a Drop of Water, even in Winter. Such are found even to the Tops of Hills, and full quite to the Day, where there are neither Springs, nor Water. There must have been Water flowing in when Metal was convey'd thither; and those Hills of the Water. Further Proof, that the Ore, and other Matter, in the Fissures, was compiled before the Departure must Water.

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must have had other terrestrial Matter equal, and on the Level with them. Consequently, both those Fissures were fill'd, and the Hills form'd before the Earth was brought to it's present State, before Passage was deny'd to the Water thorough the Strata, or the Neighbour-Land borne off, and those Hills and Eminencies left.

Killas, a Stone crack'd and shatter'd, dri-
ven quite away, and rarely found in the Shoad training from the Load in this Stone. But Growan, a Stone more solid, and continuous, ever found in the Shoad. This a Proof, that the Fissures were ex-
istent be-

Where the Load of Ore lies in Killas, the Shoad, training from it, consists mainly of such Matter as composed the Load. For Killas, being a shatter'd Stone, and having frequent Cracks in it, would fall to Pieces, and be easily driven away by the Water ; which shews, that this Action of the Water was not till after those Cracks and Fissures were made. But in the Shoads training down from the Loads that lie in Growan, there are frequently found Masses of Stone, of all Sizes to ten or twenty Ton Weight. For Growan is harder, and has not in it near so many Fissures as Killas. Consequently, it would part only into larger Masses ; which would be ponderous, and not so easily driven away, and carried to Distance.

Where the original constituent Corpuscles of the solid Strata were round, or tuberous,

tuberous, as in Free-stone, Sand-stone, Mill-stone, those Strata break indifferent-ly in any Direction. But where they were of a compress'd, or flat Form, in Manner of an infinitely fine Spangle, such, wherever they met, and their Plains became contiguous, would be apt to form flat Bodies. Indeed, they must needs do that constantly, unless where many happened to apply in such regular Manner, that the Center of the Plain of one applied to the Center of the other, so as to constitute a Column of greater or lesser Length, as the Corpuscles so applied were more or fewer in Number. But 'tis Odds whether any such would ever be form'd. This is certain, we find commonly in Stone Spangles and Plates of fine Talk. These probably, were form'd and concreted into Plates, before they subsided into Strata of that of Stone. Being of that Figure, and disper'd equally throughout the Sand, the Strata would, in Course, attain a Sort of Grain, and so be disposed to split in Plains and Flats. This is the Case of Slate, and of Killas. Bodies of such a flakey Form would be apt to subside Edgeways; and 'tis very remarkable, that the Strata of blue Killas are frequently

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quently found so placed; in some Places near erect, in others with various Inclinations to the Plain of the Horizon. They are seldom found in a flat or level Situation. Sometimes they are inflected, and variously curv'd. 'Tis common to observe in a Cliff, or any Front of Killas, of 20 Foot over, the Grain taking various, and even quite contrary Courses, in several Parts, and splitting in as various and contrary a Direction. Where the Grain runs streight for a confiderable space, and splits freely into Flats, they call it *Slate*: but where it happens to be curv'd, which is very common in *Cornwall*, they call it *Killas*. As the Plates would naturally subside Edge-ways, so the Stone that stands in that Posture, is the finest, firmest, and splits best. That which is inflected is ordinarily less firm and fine. Probably, it was put into that irregular and unnatural Posture by some irregular Agitation of the Water. I have never seen the Surface of the Sea more variously curl'd in a great Storm, than I have seen the Grain of the same Stratum of Killas. Which, therefore, splits in as various Directions. This only is constant and certain in all the Talky Stones, where

where the Spangles or Flakes lye all the same Way, in what Posture soever they happen to be, in that the Stone ever splits. The Flakes of Talk being constantly, in the Matter thus curl'd and huddled up, extremely small, fine and light, would be the more liable to be acted upon and dispos'd into a Method, contrary to that which they would naturally have taken by the Agitation of the Water. Things are thus in Slate and Killas; which seems to consist mainly of Talk, and some other very fine and similar Matter. But in White Slate, and Flag, the Strata are plain, regular, and never inflected, they lye in a Posture near horizontal. This Stone consists mainly of Sand, with only some *Micæ*, or Plates of Talk interpos'd. These Plates lye parallel to the Surface of the Strata. They lye flat, and not Edge-ways, which they do commonly in blue Slate. The Cause seems to have been, that the Sand, being superior in Quantity, over-rul'd, bore them down, and determin'd them to a flat Site. Then the white Slate breaks transversly freely, and is not near so tough and flexil as the blue is. This doubtless, consists mainly of Talk, and Talky Matter,

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ter, however subtle and fine: And Plates of Talk are known to be very pliable and flexil. Besides Flag, and White Slate, there are found Plates of Talk, some so fine as to be hardly visible, others of several Sizes, to one, two, and more Inches in Diameter, in different sorts of Stone.

Of the Origin of the Cracks in the metallick and mineral Loads. Of the Sparry, and other Matter, the Crystals, and metallick Shoots in them.

In all the Ores that I have observ'd; and, in particular, of Lead, and Tin, there are Shatters, Cracks and Partitions in the metallick Load. But in some Veins, they are much more frequent and numerous than in others. I have observ'd both in Lead, and Tin, especially the latter, the Load shatter'd into Masses, so small, that few exceeded the Bigness of a Man's Fist. Some of these Cracks are open and empty: others fill'd, or partly fill'd, with Spar, so as to make sparry Veins or Seams in the Load. Sometimes these Cracks have in them Ocre, Clay, or Sludge. At *Endellion*, I observ'd the Antimony-Vein thus crack'd: and the Cracks fill'd with Sulphur; which had transuded either out of the Mass of Antimony, or the Stone of the neighbouring Strata. The Antimony is found in Masses amongst Spar. The Masses usually cohere; being cemented together by

by the intervening Sulphur: but so slightly, that they are easily separated by a Blow, and part at the Cracks, or Veins fill'd with Sulphur, in such manner, that the Sulphur parting and adhering to the Surfaces of the Pieces of Antimony, each, after it is parted, appears like a distinct Nodule, incrusted over on the Outside with Sulphur. These Cracks seem, like those in the Strata, to have been made by a Contraction, or shrinking of the Mass. 'Tis very probable, that the Metal, and what came with it, was forced hastily into the Vein, and attended with a considerable Quantity of Water. As this deserted and got forth of the metallick and mineral Matter, it would, of Course, shrink and crack.

'Tis not improbable but the finer metallick, crystalline, and sparry Matter, not yet concreted and consolidated, coming forth of the Load along with the Water, might be formed into Shoots and angular Bodies, in the Cracks and Hollows, in the manner that at this Day we find pyramidal, and other figur'd Spars, Sprig-Crystal, Cornish Diamonds, Tin-Grains, Iron Rhombs, and the like. As the Load

The Origin and Formation of the Sprig-Crystal,]
Tin-Grains, Iron Rhombs, and other like angular Bodies.

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shrunk, and contracted, Cracks were made, and the angular Shoots, crystalline, mineral, and metallick, form'd in them.

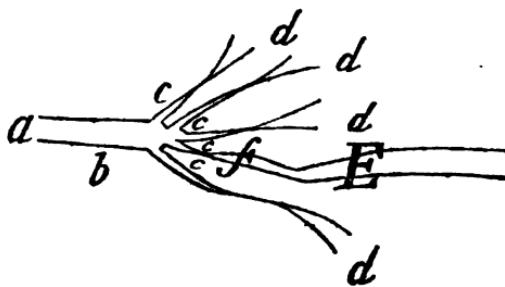
That Part In *Cornwall*, the Strata being vastly of the thick, 'tis not easy to form Judgment the Earth from them, whether the Stone on one was borne side of a Vein has shrunk or not. But off, prov- ed by the where the Main-Vein lyes inclining, and Equality of the Shelf or Top of the Rock on each side the Crec- Veins. Occasion- ally a Di- rection for Prosecuti- on of a Vein in mincing. is intersected transversly by a Cross-Vein, and the Stone on one side that Cross-Vein is sunk, Part of the Main-Vein will be, by that Means, cut off, and lower'd with the side that sunk. There are several Instances of this in *Cornwall*: And, from these we learn, that there hath been really, such a sinking. In Consequence of which, the Surface of the Strata of Stohe, and whatever else lay above it, must have sunk and sub- sided on that side of the Vein in Pro- portion. So that the Surface of the Rock, Shelf, or Strata of Stone, mast be then uneven. Whereas we now find it even, level, and plain. Which could not have happen'd any other Way, than by the bearing off, at least, all that Stone, and other Matter, that was emi- nent on one side of the Vein, and stood up higher than that on the other. 'Tis de-

demonstrable, that the Force that plain'd the Shelf was posterior in Time to that which caused the sinking of the Stone on one side the Vein. In some Places the Shelf and Vein are naked to the Day; but generally there lye broken Stones and Rubble over them. These were compil'd, and flung there, and brought from other Places, by the later Part of the same Stream, the former of which tore, clear'd off, and levell'd these Rocks, and carry'd away, and transferr'd the upper Parts along with it to other Places. In Cliffs of the Sea, and Rivers, near their *Ostia*: And in Scars, or such prominent Parts of the sides of the Rocks that are naked, near *Tenby*, and in some other Parts of *Wales*, and in several Parts of the North, where the Strata happen to be thin, I have observ'd those lying on one side a perpendicular Fiffure, sunk six or eight Feet lower than those on the other. These probably, are congenerous to the first shrink, Main-Veins, or those that hold the Loads: but are not so wide, nor so much charged with Metal, as those in *Cornwall*. Where the Strata happen to be thin, the Fissures are rarely either so wide, or so full of Metal, as there

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where the Strata are thicker. Inquiry ought to be made in the North, whether the Stone on one side the main Lead-Veins be in some Places sunk or not. In Case it be, or those mentioned above in the Scars, be Main-Veins, then the following Proposition will be of Use in mining, or pursuing of them.

In a Vein *a* that has one side *b* thus sunk, and happens, in the Pursuit, to part into several lesser Veins, *c*, *c*, &c. some of which may fly out into Strings *d*, *d*, &c. and those subdivide into Cracks still more and lesser,



and terminate finally in the Strata, without further Communication or Return to the Main-Vein beyond *E*; but one small Vein *f* proceeds on, and continues into the said Main-Vein *E*, beyond,

yond, that Crack or Vein that has one side sunk, must be the Vein that must lead to the said Main-Vein beyond.

'Tis not easy to assert there are no Those Metals where none shew themselves in particular their proper Hue. A Body, nearly Minerals resembling white Spar, with some De- company gree of Transparency, when run, yields the Metals near three Fourths of Lead. As to the Part of the Metals that are usually attended with Vein be- a Colour, Iron with Red, Copper with Green or Blue, Lead with a Soot-Co- lour, or a Yellowish, Tin, as I remem- ber, with a Grey; these may be Signs of the Presence of those Metals, but the ad- seem to be produced by the Action of Salts; so that, where there happens to be none of these Salts, none of these Colours are to be expected, though there be actually Metals. Consequent- ly, there may be Metal in the Strata, so concealed as not to be easily dis- cerned. But talky and sparry Matter are discernible and obvious in almost all Strata; though in some there is more, in others less; in some 'tis of one Com- pletion, in others of another. In sink- ing a Vein of Lead in the North, we find the Ore accompany'd with Spar of different Sorts at different Depths; But

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then the Spar of the Strata at these different Depths is of the same Sort and Hue with that that attends the Ore at each of these Depths. Where the Strata hold little or no Spar, there is little or none in the Vein with the Ore at that Height. Where Spar abounds in the Strata, there it is plentiful in the Vein. Those Strata that hold Talky Matter, have Talk with the Ore at the Ends of them in the Vein. So that in viewing the Spar or Talk incorporated with the Sand of any Stratum, 'tis easy to foretel what sparry or talky Matter will be found at that Level in the Vein. 'Twere to be wish'd the Stratum exhibited some as certain Signs of the Metal there.

In *Cornwall*, where there are not horizontal Divisions of the Stone so frequent as in the North, and the Ore lyes in the perpendicular Fissures of only one vastly thick Stratum, 'tis attended with Talk where that Stratum holds Talk : or by Spar of one Kind or other, where the Stratum holds Spar ; that in the Vein being ever of like Kind with that in the Stratum. Or, when the Spar or Talk happen to be different, at different Depths, in the Strata,

Strata, there are ever the like at the same Depths in the Vein. Which evidently shews, that the sparry, talky, and metallick Matter, came forth of the Strata in an horizontal Direction: and was neither sent into the Veins from beneath nor from above.

Though the Spar and Talk lye in such Method in the Veins, yet they do not always fill them: but are supported by their Adhesion, sometimes to one, sometimes to both sides of the Vein. There are frequently left great Hollows in the Veins: And, in breaking the Ore, Spar, and talky Matter there, we find Hollows of various Figure and Dimension; the Ore and Matter there being variously curl'd, moduled, and disposed. These Hollows are, many of them, perfectly closed: others open in to, and communicate with the Cavities of the Vein. Those are found ever empty: but these, in such Veins where there is Ore, Clay, Soyle, or other earthy Matter, are ordinarily fill'd with it: As are also the greater Cavities of the Vein. Even the very Strings, and Tops of the Veins, above the Ore; as in the North, and where the upper Strata where not hurry'd away by the depart-

The Clay, Sludge, and ear-
thy Mat-
ter, found
in the
Veins,
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and after
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was re-
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ing Mines.

O B S E R V A T I O N S

Of the ing Water, as in *Cornwall*, are full of Rise of such Soyle. This affords a Demonstra-
the Water that formation, that this came not into the Veins Rain. Of till after the Ore and Minerals were
the Heat of Mines. reposed there. We find frequently Of Earth- Soyle on one side of the Vein down to quakes. the greatest Depth we ever mine: on the other, Ore, Spar, Talk, and these, when broken, clean, and without any Soyle incorporated with them, or lodg'd in any of their interior Cavities. The Metals and Minerals concreted and consolidated as they came forth of the Strata, adhered to them, and were supported by them. 'Tis not certain but they might, in some Places, have fill'd the Fissure: and that have been widen'd afterwards by a further shrinking of the Strata; so as to make a further Vacancy, and Room for Reception of other Matter. But had Soyle, Clay, and such other soft Matter fallen into the Fissure first, they must have fill'd the whole Space as high as they reach'd: And could not have reserv'd one side of the Fissure empty, to give Reception to the Ore or Minerals. Nor could they be found, as they frequently are, quite to the Tops of the Veins. Had the Soyle come in at the same Time,

Time, and along with the metallick and mineral Particles, 'twould have incorporated with them, and filled the recited interior Cavities of them ; whereas, these are constantly found without any Soyle in them : And the interior Substance of the Ore pure, clean, and free from any such terrestrial Admixture. We find at this Day, raising the Strata, Sludge, and Clay, in the lesser Cracks, as well as in the main Fissures. Now these lesser Cracks were form'd after those Fissures ; and the Sludge brought [into both, and perhaps, into the horizontal * Seams or Fissures : which likewise frequently have earthy Matter in them, by Water passing along,] forth of the Strata of Clay, and Shiver, and other loose Matter, and reposed in those Seams, Cracks, and Fissures, where there are not Swallows in the Veins, and a thorow Passage for both Soyle and Water. Where these Swallows are, the Ore is rarely found in so great Quantity, as in other Parts of the same Vein. Probably, 'twas hurry'd away

* It ought to be determin'd from Consideration, particularly of the Thickness of these Seams, whether the Clay in them was an original Settlement : Or brought into them thus afterwards by Water.

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away by the Water, as well as the Soyle. Amongst this Clay, and in the Fissures, there is found Ore, and Spar, in Bits, and independent on the rest. This is call'd *House-Work*. Whether these Bits or Maffles, were form'd separately : or fell asunder since from the rest, and tumbled amongst the Clay, as the Fissure open'd wider, deserves Inquiry. As the Clay, and Sludge, so the metallick and sparry Matter that is found, in soft and talky Matter, in the Tops of the Veins in small Particles came in, after the other Metals and Minerals, to the Vein. It, being in independent Grains, and not concreted to the sides of the Vein, could not have subsisted there, had not the soft talky Matter come in along with it. This doubtless, drain'd upon the concreted Ore, and came in before the Clay. 'Tis certain, where there is but one Stratum that contains the Vein, and that Stratum solid, there is little Sludge in that Vein. But where there are several, some of them soft, and the Vein either in or below those soft Strata, or, there are thin Strata with soft matter lodg'd betwixt them ; there is ever found such matter in the Vein. Through the Cracks

Cracks in the Strata also the Water passes to Springs : And, through them, can bring *Bitumen*, and such other matter as could not pervade the Pores of the Strata ; rising from the Abyfs, or that Level, where the Cracks, and all Cavities stand full of Water. In fair clear Weather, when there is any Wind stirring, and Motion in the Air above, the Air below, in Mines, passes so sensibly at these Cracks, as sometimes to blow out a Candle. But, when the Rains are rising, the Moisture expels that Air, and causes such a Scarcity of it, or else a Want of Circulation of that Air, that the Candles will not burn : And withal, such a Sensation of Heat to Men, as Scarcity of Air in other Places does. Whether there be then any real Accession of Heat, ought to be try'd by a Thermometer, I think our Senses cannot determine that. Whether the Air can prevade the Interstices of the Strata, as well as the Cracks : and bear from thence volatile mineral Matter, I cannot tell. But 'tis plain, the Air will be thus expell'd out : and return alternately into these Cracks, as the Steams that supply Rain, fill, and quit them. Perhaps, this Air, when it has

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has been long, as in a great Drought, in the Earth, without being expell'd by Humidity, rising, saturated by volatile Salts, and mineral *Effluvia*, when it comes to be expell'd out of the Cracks, and brought to the Surface of the Earth, by the Steams that form Rain, is that which incommodes and affects human, and other Bodies, so much before the Humidity arises ; which, when it does arise, makes those Affections cease. But tho' no Rains actually rise, or Winds dissipate not those Salts and Fumes, the Affections continue. Perhaps, these empty Cracks allow the Earth Liberty, by their Space, to tremble in Earthquakes ; which, if solid, must either bend or break ; a Part being mov'd without moving the whole.

Of the
Mosses
found in
low
Grounds :
and the
Trees bu-
ry'd in
them.

Where there happen'd to be extended Shallow Cavities, on the Surface of the Earth, in Manner of Basons, that were not fill'd with Rubble, in the first Hurry, when the Water was fallen so low, that the Surface of it was come to the Level of those Cavities : And consequently, become more still and sedate, the lighter Bodies, floating upon the Surface of the Water, Vegetables, unctuous

unctuous and bituminous Matter, be twixt the adjacent Ridges, how far distant soever they were, would be retain'd there. Nay, 'tis not certain, whether more might not be cast up fromwards the Sea, to such a still Place, in manner of a Wreck. This, probably, may be the Case of the Fens of *Lincolnshire*.

Near the Sea-shore, by *Tinmouth*,^{Pits under the Level of the Sea at Tinmouth.} in *Northumberland*, are several Pits, sunk to a considerable Depth, beneath the Level of the Sea at low Water. These are sunk for Water, Shafts: And serve, by Assistance of Engines, to raise the Water, that is brought by Dreins, from Cole-Pits in Land. [*Mr Boyle, Hydrost. Parad.* page 229, mentions Works in Coal-Mines, that passes under the Bottom of the Sea.

About the Middle of *Bouse-Gill*, in <sup>Of *Bouse-*
Gill, in
Arkendale.</sup> *Arkendale*, where it is above 100 Yards deep, and 300 over, we drove a Work ^{This made by} a-cross it, at a Depth of about 10 or ^{the Force} 12 Yards below the Bottom of that ^{The} Water. *Gill*, in Pursuit of a Vein of Lead-Ore, ^{Strata} call'd *Scatterscar*. This gave us Opportunity of observing the Strata, under ^{zontal.} A that Gill, which were all parallel, and ^{Lead-} near horizontal. Whence 'tis demon-work'd strable, that this Gill was not form'd by ^{quite un-} either ^{der this} Gill.

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either an Elevation, or a Depression of the Strata : or other Alteration made of their original Situation by a Force beneath. So far from it, that they intersect the Gill at near Right Angles. Nay, the Ends or Edges of the Strata above appear abrupt on each side of the Gill. This shews manifestly, that this Breach, or Gill, was made by a Force above. The Ends of the Strata, of each side, answer one another : and shew they were once continuous, 'till the interjacent Stone was borne away, and by that Means the Gill formed. That this was done by Water is plainly apparent from a View of the Place.

Of other
Gills, and
the Vales
in the
North.

Both here, and in other Parts of the North, there are Ridges of Land from the two sides of which these Gills descend : and grow deeper and deeper, wider and wider, 'till they fall into one another, and approach the Sea. The whole Surface of the Earth below these Ridges must have been carry'd off to such Depth as these Valleys are sink below those Ridges ; and the Agent that did it acted with greater Fury, or the matter of the Strata made less Resistance, where those Gills are form'd. Then the Valleys grow depress'd continually

nually towards the Sea : and the Gills lye parallel, and tending towards the Sea, in such Course as Water would naturally take falling from the Ridges above. Besides, in those Vales are found smooth'd Stones, like those found on the Shores of the Sea. Many of these are of the same sort of Stone with the Strata above : but broken, and of the smooth'd, by the Water. The Strata of the Ridges from whence those Gills descend are horizontal. We work'd underneath *Boufe-Gill*, likewise nearer its Rise : and found the Strata there also near horizontal.

I observ'd several Gills in *Cornwall*, but there the Ridges being not high, and consequently, the Fall from them not great, the Gills are neither so deep, nor so numerous as in the North of *Yorkshire*; where the Ridges are very high. Indeed, in all Countries the Gills are deeper, or shallower, in Proportion to the Height of the Ridges, and the Hardness of the Stone, or other matter wherein they are.

In Proportion as the Strata, either by their Firmness, or Closeness, or by unctuous matter interpos'd, are render'd capable of debarring Access to Water, they

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Of the they preserv'd the Shells, Vegetables, and other Bodies in them. 'Tis to the animal and Closeness of Shiver, that the Plants in Vegetable it owe their Preservation : and to the Bodies in the Earth, unctuous matter in Marsh-Earth, that Water will not pass it. We see the

Of the Pyritæ, being either expos'd upon the Surface, or laid in loose Earth which Water can enter, dissolve, and fall to Pieces. So that the Strata of Clay, Chalk, and other matter, wherein they are preserv'd, must be so compact, as to refuse Admission to Water. This shews us the Reason, why at this Day we find them not in Gravel, Rubble, and other loose stirr'd Earth : but only in Clay, the Parts of which are united, and become close again, after it's Disturbance.

Some Sorts of Stone being more dispos'd to shrink than others, would have larger Fissures. The Use of this Proposition in Discovery of Ores.

A Fissure pursu'd and observ'd thro' Strata of different sorts of Stone, lying under one another, may serve, as a Gage, to shew which sort shrunk most. For, in that, the Fissure will be largest : and so contain the greatest Quantity of Ore, if fill'd with it. This Proposition is of Use in mining, where the Strata lye expos'd, as in Cliffs, sides of Gills, naked.

in the Year 1706.

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naked Rocks, and the like : As also, where there has been digging and mining in the same Tract of Land.

Tis not certain whether the Corpuscles rais'd up into the Water, subsided directly down again in the same Place. But 'tis very probable they did ; without straying or moving far in an horizontal Direction. But the observing, as we frequently do, Strata consisting of Matter of very different Gravity, lying one upon another, alternately, without Confusion, and the Matter generally pretty distinct, affords a Speculation of great Consideration. Thus, in sinking for Coal, we pass commonly thro' several Strata of Stone before we come at it. Descending still, we pass that Stratum of Coal : under that, a Stratum or more of Stone : then Coal : then Stone again. I my self have observ'd three Strata of Coal at different Depths one under another. As there was nothing to determine the Matter to subside in the Water but it's Gravity, so the Laws of Gravity must necessarily be observ'd in the Order of the Settlements and Formation of the Strata. How this was, I shall endeavour to exemplify by some Instances. 'Tis not likely there

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Of the terrestrial Matter sustain'd in the Water, at the Deluge.

Of the Concretion of the Nodules, *Pyrīta*, Flints, and the rest.

Of the Subidence and Formation of the Strata.

The Method and Order of it. Of the Iron-Nodules.

would be any Descent while the constituent Corpuscles of the dissolv'd Matter remain'd separate and single. The Water must be vastly superior in Quantity to the terrestrial Matter. Then the Corpuscles must unite, and form into Masses, bigger, or less, before they would fall in the Water. Suppose them so figur'd, that each sort upon Contact would adhere to those of the same sort, or to some others nearly of that Figure. Then each sort of Corpuscles would be form'd into Masses, Nodules, or Plates, in Proportion to the Quantity of each other sort thereabouts in the Fluid: and in each Part of the Fluid, in Proportion to the Motion whereby they were brought to meet, touch, and unite. Suppose A's 1000, B's 500, C's 250, equally mov'd in a Fluid. The A's must of Course needs meet oftener than the B's or C's: and so form Masses which had Weight sufficient to determine them to subside quicker, or before the B's or C's: and so form a Stratum of A's first. Or, if there happen'd to be more Motion near the Surface, by Reason of Winds, Tides there, or any other Cause, than below: or in any one Part of the Water, than in another; there the Corpuscles would

would, meet the oftener, and so form the Nodules soonest. •Some Respect must be had also to the specific Gravity of the Masses. As, suppose, 50 Corpuscles, of each, form'd a Mass as big as a Mustard-seed perhaps, the A's might sink, when concreted to that Bigness: The B's not 'till twice as big. Then, in sinking, Allowance ought to be made for different specific Gravity: and different Bulk. So likewise, when a good Part were sunk, the Resistance of the Fluid would be less, : And some would sink then that would not sink before. The Corpuscles of the Metals, which were in only a very small Proportion to the rest, would seldom meet to form Masses : and so would be only borne down by the Sand, or the other Matter, subsiding. Or else they would not subside 'till towards the latter End, and be in so small Masses, as to be able afterwards to pervade the Interstices of the Sands. If therefore, the Resistance of the Water impeded the Corpuscles from sinking 'till they were of such a determinate Magnitude, each according to their specific Gravity, Strata would indeed be form'd: but the large Nodules could not be found so near the

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Surface as we now find them. What Alteration the Increase of Gravity, if any such there be, nearer the Center, would make, at the different Depths, at which the Corpuscles are sustain'd, and concreted in the Water, deserves to be consider'd. Note, that most of the Strata that differ in Matter, and Constitution, have in the sides next them, some of the matter of the Strata next adjoining. I think Nodules are only found form'd of Crystal, Iron, Talk, and Pyrites. So that it seems probable, that no other Sort of Matter could form in the Water any larger than Grains, for want of a Disposition to concrete. For these have all much the same Texture: and an Appearance as if they had been melted. So that where they were form'd, the Matter was small and fine: And, as there are Leaves of Plants in them, perhaps it was near the Surface; but extending down deeper to some considerable Depth. When the Nodules were forming, beginning at one Corpuscle, either that mov'd towards the rest, or the rest towards that, or both. The Motion was either horizontal, or perpendicular. If the Nodules or Masses concreting, had moy'd horizontally, then,

then, leaving the Place, and Matter, where they first concreted : and passing to another Place, where there was different Matter they must, subsiding, be found in that, *i. e.* in Strata where there appears none of the Matter of which they are form'd, which they, I believe, never are: but always in such as they are form'd of; except those that have been since wash'd out, and reposit'd amongst Rubble. I cannot conceive how the Concretion, or Nodule, could stand still : and the Corpuscles move horizontally towards it. If the Concretions mov'd in a Perpendicular, then they gather'd their Parts in subsiding, and so got their differently colour'd Coats in the different Matter through which they subsided. Their Figures, which generally tend towards round, seem to hint that they were form'd in subsiding. For, if they had mov'd to the Corpuscles, or the Corpuscles to them, horizontally, they would have met only in Lines parallel to the Horizon, and so have form'd Figures tending towards a Flat. If where there are seyeral thin [of 1, 2, or 3 Foot,] Strata of different Matter, as there is where the Iron Nodules are: And those Nodules are not found lodg'd in

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in the Strata, of different Matter, above, or below, but only in the Strata that abound with Iron, 'tis a Demonstration, that they were form'd of the matter of that Stratum: And, in subsiding amongst it. At Major *Hanbury's* Works, near *Pontypool*, in *Wales*, and in several other Places that I have seen, the Nodules, that they work for Iron, lye sometimes, as it were, in a Floor, regularly, like the Flints in Chalk: but ever only in Strata that contain somewhat of Iron; tho' no-where so rich as the Nodules. In some Places the Iron Nodules lye irregularly and dispersedly in the Stratum. These Strata are in some Places of rusty Stone: in others of Shiver. I have never found any Iron-Nodules in Earth, or loose Matter. Indeed, there is never any such loose Matter found, in sinking, after once we come in amongst the solid Strata, though we sink never so deep. Only there are, betwixt Strata of Stone, sometimes Seams of Clay: from a Line to near an Inch, in Thickness. This I have observ'd in *Yorkshire*, *Wales*, and elsewhere. In some Places the Iron-Nodules are parted into *Tali*, after the manner of the *Ludus Helmontii*: And indeed all the *Ludus Helmontii* found about

about *London* holds some small Proportion of Iron in it.

Where there is much Spar intermix'd Of Spar it has made the Strata more close and incorporated with solid ; so as to approach Marble, both the Sand as to Constitution and Firmness. Small Of the Veins of Spar in Stone are firmer, and Veins of endure the Weather better than the Stone it. These itself. The Shells, *Entrocbi*, *Afferiae*, Weather and *Coralloids*, stand the Weather better than the than the Stone : as

do also Shells, and some other like Bodies.

The End of the Twelfth Volume.



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A





A N
I N D E X
O F T H E
H E B R E W W O R D S,

Which are mostly put under their Roots ;
and the Meaning of the Roots given
in a brief Manner.

א

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אַבְנֵתְ; a Girdle, E. 179.

אָבְרָךְ, Father of the Blessing, G. 292.

אָבְרוֹהָםְ, Father of the Purifier of many,
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- אָדֵן, Hinge, Lord, E. 217. F. 66-8.
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- אָוָר, Flowing, a Stream, so Light, A. 19-25.
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אֶמֶת, Mother, Cubit. Q. 22.
אַמְנָן, a Nurse ; faithful. D. 272. N. 333.
אָמֵר, to branch out, say, command. D. 175.
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M. 121.
אַנְחָה, to fret, rub. חֲנָה, Contrition, the
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אָנוֹשׁ, Man, a miserable one. F. 142, 3. 151.
אָפִיר, a Prisoner, E. 36.
אָפָד, the Ephod, K. 441.
אָפָל, hard and close. D. 132, 4. M. 120.
אָגָר, Nose, Anger, F. 201. M. 264.
אָקָרָה, Carbuncle. D. 399.
אָרְבָּה, to lie in wait, as a Beast in a Hole,
Crack or Den. אָרְבָּות, the Cracks
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אַת, the, very, Substance. D. 32.
אָתָה, to come. Fire. D. 372.
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ב

- בָּבָל, mix, confound. G. 333.
בָּגָד, a Cloak, Diffimulation, N. 87.
בָּדֵל, to divide, sepaate between. D. 231—3. 450. M. 134.
בָּהָו, void or empty, as a Vessel with no Liquor in it. A. 8. F. 28.
בָּאוּ, to come from one Place to another. D. 527.
בָּגָל, move by Impulse, make flow and mix. D. 29, 30. 146. G. 330—4.

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- בָּכָר, first-born. E. 233. M. 98. 271.
- בֵּית, a House, Family, Temple. I. 129. M. 211. 243.
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- בָּנָה, to build, a Pattern. Q. 69.
- בָּעֵל, Lord or Ruler, D. 56. 145—8. 498. G. 361. 398.
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- בָּקָר, the Morning ; to enquire. D. 247.
- בָּקָשׁ, to seek or apply to. F. 121.
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- רָגֵן, Rapine, an Eagle. E. 237.
- טַלְגָה, Cold, Ice. D. 125.
- רָלֶל, to roll, revolve. D. 257-60. 418. 515-
20. G. 282. 346. Q. 41-5. 68.
- מִלְכָלָה, Captive-taker. Q. 26.
- מִלְלָה, Revolution of Revolutions. D. 515-
20. 523. G. 347. מִלְלָה, a Name
of the Heathen Gods, from the Re-
volution of the Matter and Orbs; or
the Air. D. 515. G. 430.
- מְלַאֲךָ, to distribute, make Return, wean. G.
476. N. 385.
- מְנוּרָה, to sojourn. G. 43. M. 218. N. 336.
- נָנָה, to protect. A Garden. E. 112, 20.
- גָעַל, to cast away, loath. E. 32.

ר

רְבָרָה, a Word, Secret brought to Light,
the outward Expression, so Type or
Ceremony. E. 225. F. 220. G. 19.
I. 48. 161. 256-65. K. 273, 7. &
seq. M. 90. 286. N. 101. 219. 355.
Q. 53.

רְבָלָת, G. 497.

רְגַנָּה, the Multiplier. G. 487.

תְּדַ,

INDEX to Hebrew Words.

- אֶחָד**, the Beloved. F. 106. I. 206. K. 312.
M. 97. 219. N. 288.
- אַדְמָה**, sick. N. 337.
- אִנְהָרָה**, to judge, distribute. M. 62.
- אָרוֹן**, **אָרוֹן**, to live, generate. Fire, circulate
as Fire. D. 987. E. 243. 258-62.
G. 311. N. 57. 98.
- אָרְדֵּנָה**, to impell, drive along. D. 134. 323.
- אָזֶן**, enough, sufficient. D. 78. E. 356.
- אָלֵק**, burning. D. 399.
- אַלְבָד**, the Blood. E. 33. to stay, cease acting.
D. 464. **אַלְמָחָה**, to liken, give a Similitude. D. 32. E. 29; 39. **אַלְמָתָה**,
Similitudes. G. 276. I. 375.
- אַלְפָתָה**, Fear, Trembling. G. 457.
- אַלְקָה**, frothy, light. D. 391.
- אַלְמָנָה**, a Road, Way. E. 219. I. 141.
- אַרְשָׁה**, to enquire, require of. F. 122.
- אַתָּה**, a Statute. N. 167.

א

- הַבָּלָל**, Fleeting, Vapour, Vanity. D. 146.
375.
- הַרְטָה**, the Myrtle. E. 154-7.
- הַדָּר**, Honour. I. 26. M. 299: the Tree of
Life.

INDEX to Hebrew Words.

- וּ�ת, He. Arab. Wind, Air. F. 31-3. 47.
דָּרֶךְ, Glory, Majesty. I. 209. M. 122.
159.
הַזְּהֹן, the Power of existing and reasoning, F.
22,3. H. 31. K. 217,21. 341—6.
דָּוִין, Substance. F. 23. K. 344.
הַיְמָלֵךְ, the Temple. G. 326. M. 242.
דָּלֵל, הַלְלֵל, to irradiate, shine as Light does,
up and down and every Way. Praise:
D. 525,6. E. 98. F. 6. 10, L. I. 289.
M. 96. N. 287. 305. 330.
הַלְּקֹחַ, to go along. D. 530.
הַלְּמֹד, to batter to Pieces. N. 361.
הַמְּנוּנָה, the Multiplier. G. 473. חַמְּתָה, Mob,
Confusion, Disorder. D. 520.
עֲנָגָן, the Mover. D. 319. G. 418.
חַמְּפֵךְ, to change Conditions, turn over, D.
486. I. 137,9. K. 425. P. 44.
מַרְאֵה, a Mountain. N. 315. מִשְׁרָחָן, Concep-
tion. E. 488. G. 461.
חַרְבָּה, Mercury, the Agent that projects
Things. D. 315-9. G. 91. 424. I. 17.
חַשְׁבָּה, a Lamb. E. 235. M. 271.

I, Such a Connection as the Context requires.
So, therefore, and. D. 152. 339.

זְבוּב,

INDEX to Hebrew Words.

- בָּבָשׂ**, to flow, a Fly. G. 426.
בְּנֵת, to kill, sacrifice. G. 164. I. 13. K. 109.
בָּרֶךְ, Brightness. D. 468.
בָּרַכְ, to flow. G. 426.
בָּזָה, Door-posts. Q. 22,4.
בָּזָלֵל, a Serpent. E. 155.
בָּזִית, Olive-tree. E. 215. 254. M. 43. 119.
בָּכָר, pure, clean. E. 209.
בָּכָר, a Male. To remember. M. 300,12. 368,74,6. 389. **בָּכָרָן**, a Memorial, M. 272. 365,85. **הַזָּכִיר**, M. 386. N. 334.
בָּמָר, to prune. Vine. Song. N. 308.
בָּרֵךְ, to alienate, disperse. D. 130-2. G. 38.
בָּדָד. D. 528. **בָּרִיךְ**, Grains of Spirit. G. 318.
בָּרָא, to spring or rise up as Light from the Sun. D. 393. 527,8.
בָּרָעַ, the Arm, Seed. F. 176. M. 96.

ח

- חַבְלָה**, a Company, whence **חַבּוֹלָתוֹ**, in Chorus. D. 486.
חַבָּר.

Index to Hebrew Words:-

- חֶבֶר, Bunch, Swelling, Wound. N. 335.
- צָג, to go round in a Circle, Circumference, a Year. D. 259. M. 272. חַנְג, D. 257, 8, 417. E. 244. G. 429. תְּמִלָּה, to roll and go in a Circle. D. 25-9. G. 429. גִּלְגָּל, a Circle.] E. 175-9.
- חַדְלֵי, a Temporiser. L. 86. N. 197.
- חַזֵּה, Reveal, bring hidden Things to Light. E. 199.
- חַזֵּן, to see. N. 275. 354.
- חַטָּאת, to miss the Mark. Sin. I. 193. N. 45. 336.
- חַיָּה, Life. E. 26-9. 299. תְּבִיאָה, Lives, Immortality, living ones. E. 26. 45. 2. 123. F. 174. תְּבִיאָה, the Instrument of Life, F. 44.
- חַיִל, Virtue. M. 154. P. 351.
- חַכְמָה, Wisdom. P. 351. Q. 10.
- חַלְבָּה, Fat. E. 233.
- חַלְהָת, whence' חַלְלָה, Infirmitv. N. 349.
- חַלְלָה, Dancing. Piping. D. 419. 526.
- חַלְלָה, חַלְלָה, L. 208. מְלֹאָה, to renew, change, sprout out. E. 209.
- חַלְקָה, to make smooth, dividing. D. 238. הַלְלָקָות, smooth Stones. D. 134.
- חַמְדָה, desireable, sacred. E. 120-2. I. 146. אִישׁ חַמְדוֹת, Dan. x. 11.

חַמְדָה

INDEX to Hebrew Words.

הַרְאָה, the solar Fire, Heat, Fury. D. 128.
155. 385-90. 461-89; F. 201. N.
268; P. 44. **סֶמֶן**, Sand-fire Image. D.
386-9. **שְׁמִינִי** acid, leaven. D.
386. G. 279.

גָּנָה, gracious. F. 158. G. 525; N. 250.

חִסְכָּה, compassionate. I. 18. M. 134.

חַדְשָׁה, Strength. E. 254.

חַצֵּר, Tubes, Straw. D. 526. G. 479.

חֲפֹתָה, Marriage Chamber. D. 484.

קָרָב, a Statue. E. 219. Lawgivers. K. 172.
313. M. 272. **קָרְבָּן**; B. 432.

חָרֵב, to slay by cutting off. Sword. F. 137.
K.

חָרָה, Burning. B. 392, 3. G. 269. **חָרָה**
Fire, Heat, Anger, Serpent. D. 392.
3. E. 201. F. 201. G. 280. **חָרַת**
to devote, execrate, to Destruction.
G. 276. M. 129, 30. **חָרָץ**, the
filisk. G. 276. **חָרְבָּן**, G. 269.
חָרְגָּמָר, the Fury of a young Bull.
G. 280. **חָרָם**, the solar Fire, D.
393. F. 38. 201. G. 280.

חָרָם, Winter. G. 436.

חָרָשׁ, Cyrus, the Sun. G. 280. 297.

חָזֵב, Counsellor. D. 283. I. 394. M. 57.
Q. 11.

חָזֵה, mute. E. 156.

חָשֵׁךְ

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גַּזְוָן, to storken, stagnate, dark Air. A. 9.
D. 119-24.

גַּלְגָּל, a Bandage, swaddling Band; the Ex-
position so called. D. 136. K. 458.

ט

טוֹב, Good, in order. A. 54. D.

D. 45t. E. 129. G. 123. M. 97. 242.

טוֹבָה, the Spider, to weave; E. 149.

טוֹרוֹת, the Reins. E. 3t.

טוֹרָה, Row, Rank. Q. 57, 60.

טוֹרֵחַ, clean. E. 138. 209, 10.

טוֹלֵס, G. 145.

טוֹעֵם, a Decree. N. 107.

טוֹרָה, to weary, or wear out. D. 128.

טוֹרָךְ, Prey. M. 289. 301.

י

יָאָרֶת, Flowing. E. 135.

יָבֵל, to flow. G. 331.

יִזְחַח, to yield the Hand, the Power, to con-
fess, I. 13-9. M. 342.

יִדְעַת, to know, feel, experience. E. 129.
175. G. 343, 6. Q. 10.

יְהֹוֹדָה,

INDEX to Hebrew Words.

יהודה, Judah; Confessor of Jehovah, D. 147.
 I. 14. N. 343. **הָאָ**, the Essence. E. 39. 258. F. 3. & seq. H. 3. M. 14.
יהוָה, the Essence existing with Power. F. 21. & seq. H. 249. K. 62, 5.
 74. 82. 337. M. 14. 206. N. 219.
לְהִ, Let there be. A. 19, 20. D. 175,
 6. 247-9. 368, 9. **יְהוָשָׁעַ**, the
 Essence, the Saviour, and **הַרְצָךְ**,
 M. 182. 199.

יּוֹם, Day. D. 417.

יְחִידִים, to unite. **יְחִידָה**, Peace-makers. N. 356. **יְחִדָתִ**, my joint one. N. 320.

עַטֵּל, to plant, fix in the Ground. E. 111.

יְכַחַ, to plead, argue a Case. N. 336, 44.

זָוֵן, a Dove. E. 235.

יְנֵן, Wine. G. 499. M. 276.

לְבִין, D. 81.

לְדִ, to beget. G. 472. **חוֹלְדוֹתָה**, Generations. N. 55. 239.

מָהָ; Water. G. 355.

יְנַהַ, to oppress. N. 351.

סָרֵ, to found, lay a Foundation. Element. D. 33, 5. 302.

עֲזָבָן, an Owl. L. 91.

יְפַנֵּ, to infuse, breathe in. E. 26. 36, 7.

יְפֵ, Beauty. E. 254. I. 208.

C

יְפֵ

INDEX to Hebrew Words.

- וְיַדְךָ**, to move as Atoms, or Grains, or Marbles in a row, one pushing another. D. 116. 402, 3. I. 32.
- אֵלֹת**, to come forth. D. 457. 557. M. 30.
- בָּזֶבֶץ**, to stand. P. 44.
- רְצִוף**, compreß, straithen into the least Com-
pact. D. 133, 8, 9. 140. P. 351.
- מִצְבָּח**, to form or fashion. D. 5. 135, 6. 410.
(where it is misprinted) Q. 15.
- שְׁאֵלָה**, Burning, melting the Grains into Atoms. D. 385. 399.
- עֲדָם**, small, fine, precious. D. 178. G. 123.
N. 341. P. 351, 2.
- אָנָּטוֹן**, To fear. E. 30.
- תְּדִין**, to subdue, bring down. D. 301. G.
553.
- יְרוּשָׁלָם**, Jerusalem, Possession of Peace. I.
218.
- לְמִילָּה**, the Lunar Light. D. 129. 432. 464-8.
G. 301.
- שָׁבֵב**, to inhabit. D. 116. N. 336.
- שָׁיָה**, Being, existing, some one. F. 7. **שְׁמָן**,
D. 56. F. 7. 193. G. 419.
- שָׁמַע**, to save. F. 4. 60. I. 207. M. 355.
- יְשָׁרָאֵל**, Israel, the Prince of the Irradiator.
F. 159. I. 214.
- תְּחַרֵּךְ**, to redound. I. 23, 4. the Gall.

כבר

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ב

כְּבָרֶת, Gravity, Glory. E. 120. 254. F. 164. I. 1. & seq. 23. 233, 5. 364. 391. R. 11. 39.

כַּרְנֵעַ, Intercessor. E. 221. F. 62. G. 327. I. 239. M. 138. M. 199.

כַּוֹת corrode, as Fire does. D. 361.

כַּזְבֵן, to prepare, fit; form. D. 81-3. 88. 182, 91. **כִּינֵס**, So; right. D. 81, 2. 426. **כִּינֵסִים**, the Mechanism of the whole System. D. 81. G. 465. **כְּכָלָן**, a Machine. D. 83. **כְּכָבִין**, Machining, framing. D. 45. 82. 306.

כְּגֹרֶר, Arab. to wreath a Turban round the Head. D. 291, 2.

כְּגֹזֶת Power; the Virtue in a Tree, &c. **כְּיֹור**, the Focus, Action and Place of Fire. D. 179. H. 11. L. 44.

כִּימָה A. 72, 3. D. 485.

כְּבָבָק, the Flux of Light from a Star. G. 307. **כְּכָבָקָה**, D. 363. 432, 62.

כָּל, All. To all, or compleat. D. 95. N. 248. **כָּלִי**, an Instrument, Apparatus. D. 96, 7.

כְּלָאָה, M. 130. **כְּלָאָה**; the Reins. E. 31. **כְּלִיוֹת**, the Reins, or Vessels, Containers, of the Trunk. E. 31.

כְּמַתָּה, Desire, or Lust. G. 300.

כְּבָטָן, a Female Ornament. G. 459.

כְּמַרְ

INDEX to Hebrew Words.

- כָמֵר**, the Priest of the Fire. G. 305.
כְמַשׁ, the Solar Light. D. 277. 483. G. 300.
כְבִנָה, Tabernacle. E. 111.
כְסֵת, a Throne. D. 484. I. 175; to cover. Q. 63.
כֶפֶת, Cavity, Hollow of the Hand. Bough. D. 197.
כַפֵּר, to cover, expiate. I. 41,7. 127-37.
כְפָחָר, a Sphere. Q. 21,3.
כָרָה, to go round. D. 290-2. G. 300. 337-48. **כְרָכָר**, to dance in Rays or Circles. D. 291. G. 336. **כְרָכָחות**, Chariots. D. 292.
כְפַתֵּח, compounded of **כְבִין** like, and **רַב**, great. I. 114,9. 383. **כְרָבִים**. D. 106. 285. E. 156. G. 273. I. 42. & seq. 101. 365. K. 356. & seq. 419.
כְרָם, a Vineyard. D. 390. G. 492.
כְרָס, D. 523.
כְרָשׁ, Cyrus. Lord. E. 38.
כְרָת, to slay, or cut off. E. 230. G. 365,78. I. 410. K. 119. **כְרָתָה**, a Divorce. G. 367.
כְשַׁלֹּוֹן, Falling down, as Rain. D. 486.
כְתַב, to mark down, write. G. 33. M. 14.
כְתָם, N. 315,6.
כְחַזָּן, a Coat. E. 202. 247.

בְתַר,

INDEX to Hebrew Words.

כְּתָב, a Sphere, or Crown. Q. 25. 32. 55.
64. 70.

ל

לֹאַךְ, to send, employ. D. 102.

לְבָאוֹת, compounded of **לֵב**, the Heart, and Knowledge, and **אֹתָה** Sign, or **בוֹא**, to come. D. 371-4. G. 442. **לֵב**, the Heart. E. 45.

לְבִנִים, white. Q. 27. **לְבִנִים**, white Bricks. M. 257. **לְבָנָה**, the Lunar Athth, or Cap of Light on the Moon. D. 461-88. Frankincense. M. 187. 257.

לְבַשׂ, to invest, put on Cloaths. E. 247. K. 435. N. 88,9.

לְהַטָּה, to burn. I. 137. N. 351.

לוֹחַ, to couple. I. 210. **לוֹחַ**, the coupled one. I. 210-3. **לוֹחַן**, a Serpent. 213.

לוֹחַ, Green, Verdure. E. 254.

לוֹחַי, to the Living one, F. 41.

לוֹחַם, Bread, what is got by War. G. 594-9. M. 31. 236,76. 313,4. **חַמְרָה**, daily Bread. 237. **אֲבִירִים**, of the strong ones. 314. **עַצְבִּים**, of Sorrows, 378.

לוֹטָה, to hang as a Drop. Q. 27.

לוֹזֶה, coupled Figures. I. 211. 374.

לִילָה,

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לְיָלָה, the Night. D. 473.
לִקְרָא, to take, or catch. D. 523, F. 8.
לְשׁוֹן, the Tongue. G. 27. 81.

בּ

בָּאֵת, Hundred, many. Q. 68.
בָּאַדְמָה, his Typhus. D. 122.
בָּאַמְתָּה, the Light. D. 360. 431, בָּאַמְתָּה, a
Chandelier, Instrument for Light. D.
356-8. 361. 426-31. K. 43. בָּאַמְתָּה,
D. 359. 463. בָּאַמְתָּה, a Chandelier
with the Light in it. D. 359, 63, 7.
420, 6. בָּאַמְתָּה, Burning Heat. D.
361. בָּאַמְתָּה, a Stream of Light 361-
ing, or that which makes it flow and
act. D. 177. 360. 431, 2. F. 203, 4.
כְּבָשָׂעָה, the Deluge. A. 65, 6. G. 330.
כְּמַזְבֵּחַ, Fruits. G. 303.
כְּמוֹת, Decay, Rot. D. 304-7.
כְּהַבְּבִת, the Asp. F. 162.
כְּמַתָּה, Similitude. G. 269.
כְּמַגְנִית, Going forth. D. 25. 485. M. 38, 314.
כְּמַזְבֵּחַ, depart, recede. D. 54. 307. 483. G.
300.
כְּמַעֲשֵׂה, Institution, Appointment, Seasons. D.
409. Tabernacle. I. 148. M. 177.
190.

בְּמַבָּדָה.

Index to Hebrew Words.

- מִזְהָה, Heat. G. 299. מַלְאָה, the Fluxes of Light from the Planets or Stars. D. 433. 52, 98. G. 304.
- מָוֵה, Dispersed, Stranger. D. 430-2. מָרוֹתָה, the Grains of Spirit, 132. 414.
- מְזֻבָּד, to subdue, beat down.
- מְחֹר, to-morrow, an Exchange. D. 254.
- מְפָרֶר, Rain. D. 445.
- מְשֻׁעָם, לְשֻׁעָם מְשֻׁעָם, a Plant to the Name. M. 96.
- מְשָׁטָם, Waters. A. 27. D. 51.
- מְלָח, Salt. N. 19. מְמֻלָּחָה, salted. M. 184.
- מֶלֶךְ, King, Leader. D. 57. 104-5. E. 180. F. 9. 58. & seq. G. 88. 394. K. 305. N. 110. מֶלֶכְתָּה, the Power, or Kingdom, or Queen of Heaven. D. D. 104. F. 66. מֶלֶכְיָצֵד, and שְׁלָמִים, M.
- מֶלֶאָךְ, an Agent, D. 102. F. 129. & seq. 148. & seq. 161-8. H. 105. K. 321. 452. מֶלֶאָכִים. D. 107. F. 151, 2, 6, 8. K. 321. 452. מֶלֶאָכָה, mechanical Agent, Sing. and Plur. C. 13. D. 4. 96, 7. F. 130. 180. G. 400. P. 42. Q. 12.
- מֶלֶלֶל, to speak. D. 482. F. 220.
- מֶלֶיךְ, a Gentleman Usher. G. 79. I. 548. L. 34.
- מְנֻתָּה, To distribute, compute. G. 517. נָתָן, a God. G. 89. 517. מְנָה, Manna. G. 518. מְנָה, D. 959. מְסֻכָּה,

INDEX to Hebrew Words.

- מִסְכָּה**, Tabernacle. N. 268.
- מַפְסֵס**, to melt. D. 399.
- מַעֲגֵל**, an Instrument of Progression by Rotation. G. 285.
- מַעֲזִים**, Powerful ones. G. 349. 416. Q. 84.
- מַעֲכָה**, to squeeze, or compress. D. 327. G. 413.
- מַעַן**, the Power of Generation. G. 454. Habitation. I. 364. M. 212. **מַעֲנִית**, Fountains. A. 68. I. 208. **מַעֲנִינִים**, Cloudmongers; or Observers of Times. E. 269. G. 441.
- מַעַף**, Flying or moving by Compression. D. 138. 327.
- מַעַד**, Adhesion. I. 210, 2.
- מַפְלִצָּת**; an Idol. G. 456.
- מַעַלְבָה**, a Statue or Pillar. D. 192. E. 269. I. 146. K. 375. M. 116.
- מִצּוֹת**, Commandments. E. 219. Unleavened Bread. M. 276.
- מִזְרִים**, Ægypt. Afflictors.
- מִקְרָא**, the Sanctuary. I. 145. M. 217. 220.
- מִרְכֶּבֶת**, the Power that presides. G. 423.
- מִרְדֵּך**, the Agent that makes Things come down. G. 553. H. 211.
- מִרְאָה**, an Appearance or Representation. D. 141. E. 122. F. 127.
- מִרְחָה**, to rebel against. N. 383.
- מִרְחָה**, Instrument of Impulse. D. 165.
- מִרְכָּבָת**, Instrument of Motion. D. 150, 64. **מִרְקָלִים**,

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- מְרָקִילֶם, Mercury. D. 316, 7.
מַשָּׁא, a Burthen. I. 6.
מֹשֶׁה, Moses; to draw out. F. 203. M. 467,
8. 182.
מְשֹׁחַ, to anoint, constitute, 106, 7. 158.
מְשִׁיר, E. 215. M. 156, 7.
מְשֻׁךְ, to draw. D. 389. G. 123.
מְשֻׁלָּם, Image, Rule, Parable. D. 437. E. 188,
90. H. 11. N. 364, 5.
מְשֻׁכֵּן, a Dwelling Place. I. 170. H. 25.
מְשֻׁקֵּל, Weight. D. 154.
מְתַהֲלָלִים, G. 271.
מְתַחְפֵּר, D. 486. I. 137, 8.
מְתַלְקָה, Catching itself. D. 523.

ג

גָּאֹזֶן, Desirable. N. 329.

גָּבֵל, to drop as a Leaf from a Tree. A. 66,
D. 30. 143. גָּבְלִי, Destructions of
Grains of Air. D. 142, 3.

גָּבוֹן, Revealer of Secrets. B. 91. G. 446.
גָּבוֹנָה, to shew by Vision. G. 447.

גָּבִיא, a Prophet. F. 63. M. 96. 164.

גָּנוֹן, to set before, shew, Ruler. D. 400. G.
354. K. 327.

גָּנוֹת, to shine, glitter. D. 432. 523.

גָּזָר, to impel, or drive along. D. 134.

ד

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- נָהַר**, to flow as Light, &c. do. D. 359.
468. E. 135,7. F. 211.
- נָזֵל**, to wander. D. 307. remove. M. 15.
- נְעָם**, Quietness, an Acquittance. E. 234.
נִתְחַנֵּן, to place. E. 140.
- נָגַן**, to move from Place to Place. D. 307.
- נָגַן**, to wave, move every way. E. 222. 242.
Q. 34.
- נָרָה**, Fire or Light. D. 359.
- נָזֵל**, to flow. D. 462. 498.
- נְזֵם**, Earrings. D. 416.
- נָזֵר**, to separate. Nazarite. F. 128. Crown.
M. 227.
- נָחַל**, a Brook.. E. 258.
- נָחַם**, to comfort, repent. N. 381.
- נָחַשׁ**, Serpent. Bras. Augur. E. 154-7. M.
267. Steel 351,2. **נֶחֱשָׁבָה**, **נֶחֱשָׁבָה**
brassen Serpent. E. 156.
- נָטַף**, to decline, nod, turn aside. D. 217.
300-3. K. 284.
- נָטוֹל**, Heavy, depretted. I. 6.
- נָטַע**, to plant or fix in the Ground. D. 504,
5. E. 110,1. M. 96.
- נִיחַח**, Rest. P. 75.
- נִכְחַד**, formed, framed. D. 256.
- נִכְרָה**, unknown. G. 343-8.
- נִמְנַג**, to melt away. N. 363.
- נִמְבָּה**, the Changer. G. 441.

נִכְרָה

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נָסִיכִים, Prince, molten Image. G. 240.
M. 229.

נְסָרֶך, G. 402.

נָשַׁחַת, to blow, or breathe. D. 170, 34. § 66.
400. G. 309.

נָפַל, to break to pieces. D. 401.

נָפָל, to go forth. D. 402.

נְפָלָה, the Animal Frame. E. 26-35. G. 394.
K. 119.

נָעַם; standing open; consisting of. F. 149, 50.

נָצֵר, Conqueror, uppermost Street. N. 304.
336.

נָצַר, to keep, or gird round.

נָמֵג, the Avenger. 201, 8.

נָקַט, to go round; or surround. D. 256, 7.

נָרָגֵל, the Fire circulating. G. 281.

נָרִיחַ, the Lamp of the Efficient. G. 282.

נָרָת, Lamp. D. 359, 85. M. 248.

נָשָׂא, to lift up. Vapours. D. 144. 401. E.
181. 232. a Chief. I. 212, 5. M. 219.

נָשָׁם, the Soul, a Mole. Halitus. D. 154.
E. 26. 38-45. 150.

נָשָׁמָן, to blow; impet. Twilight; an Owl. D.
170. 256. E. 187. L. 91.

נָשָׁר, an Eagle. D. 286.

נָתַךְ, to melt, pour out. D. 402.

נָתַן, to give, D. 440.

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- סְבִיב**, a Circuit. D. 523. F. 4. 226. G. 270. Q. 61.
- סְבָך**, Perplexity. E. 254.
- סֵם**, a Horse. D. 115.
- סַרְר**, some Serpent. D. 506.
- סְכָך**, to cover, the Circumference of Heaven. G. 472. M. 219. N. 83. 6. 272.
- סְכָת**, the Covering or Tabernacle. M. 97. 219.
- סְכוּת**, E. 251, 5. G. 468.
- סֶלֶה**, Selah, mind this. M. 218. 354.
- סְמָל**, the Power of the Air. G. 290.
- סְמִים**, sweet Incense. M. 184. 257. Chald. Poison. 263.
- סְנָה**, a Bush, Tree or Grove. I. 351. 364.
- סְעַד**, to support, or shore up. D. 193.
- סְעֻר**, a Storm, or Whirlwind. D. 192.
- שְׂפָת**, a Porch. Q. 21-4.
- סְפָר**, to record, write. D. 272. 518. G. 33. I. 25. M. 14.
- סְרָח**, a Turban, Irradiation. G. 277.
- שָׁרֵס**, to depart, recede. D. 192.

עַבְתָּה,
Reign.

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ע

עַבְתָּה, Density. D. 125. עֲבֵי, dense
Graints. 126. עֲבִיטָה, 115.

עַבְרָה, to till the Ground, to serve. E. 141.
K. 409.

עַבְרָה, to pass along. A. 85. E. 141-3. 228.
G. 45. 365. K. 106. N. 343. Q. 79.
בְּעַבְרָה, E. 191.

עַבְתָּה, Thick, dense. D. 279. E. 254, 8. 267.

עַלְלָה, Round, a Yearling. Waggon. D. 417,
8. 1519, 20. G. 263. N. 321, 55.

עַד and **עַדְדָּה**, to institute, appoint. M. 202-
4. 300. 372. **עַדְמָם**, Instituted
Things, Ornaments. E. 249. I. 147.
M. 203. N. 87. **עַדְתָּה** and **עַדְתָּה**,
Testimony, Institutions. I. 147. K.
418, 9. M. 103. 212. N. 352.

עַדְןָה, Edén. E. 110-6. Pleasures. 136.

עַדְתָּה, yet, further. F. 28.

עַזְבָּה, Iniquity. E. 176. G. 353. M. 361. N.
335.

עַזְבָּה, to fly. D. 138. 402.

עַזְבָּה, Skin. E. 202, 6.

עַזְבָּה; a Bone. Strength. Confirmation. 535.
H. 11. K. 420. M. 154. **עַזְאֹלָה**, the
Scape-goat. F. 138. **עַזְמָות**, the
Strength of Mind or Death. G. 539.

עַטְרָה

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טוֹבָה, to encompass round; a Crown. D. 512.
F. 200. I. 27. Q. 32.

עֵין, the Eye. P. 352.

אַכְשָׁבָה, an Adder. E. 155.

עָלָה, to ascend. D. 431. ⁴Banth. E. 175.
A. 214²⁵. 237. N. 37²⁵. יְלִיעָה;
550.

עַלְמָה, Darkness, Cloudiness. D. 128.

עַלְמָה, hidden, Time past or to come. עַלְמִים;
Ages, Immortality. E. 46.

עַמְדָה, to sublif, support. D. 183-97. 285.
305. 466. F. 32.

עַמְקָה, deep. G. 351.

עַמְתָה, near. Q. 78. עַמְנוֹאֵל, God with
us. I. 29.

עַנְנָה, a Cloud. D. 128. 144. 150. I. 150. K.
456. עַנְנָנִים, Cloudmongers. D. 150.
K. 460. עַנְנָה and עַנְנָה, D. 150. 419.
G. 526. K. 460. עַמְלָקָה, G. 526.

עַנְעָה, a Bough. E. 258.

עַנְקָה, a Chain for the Neck. D. 429. G. 522.

עַפְרָה, Atoms. Dust. D. 3. 35. E. 191. G.
121. M. 77.

עַצְם, Body, Substance. D. 424. K. 360.

עַקְבָה, the Heel; to supplant. E. 185. 7. N.
343.

עַקְעָה, to root. D. 115.

עַזְבָה.

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ערב, to mix; the Evening. D. 170. the Willow. 192. E. 238. G. 42. 246. M. 43,4. ערבה, D. 249,47. G. 337. ערבות, D. 28. F. 4. 364
Mixers.

ארע, Line. Furrow. E. 135.

ערה, to empty, put, or pour down. D. 147. 8. M. 220.

ערך, to rank. M. 237-40, 265. 320. N. 273.

ערט, Cupping. Naked. E. 175. 247. G. 94.

ערף, to distil; flow down; the Neck. D. 128. 468. ערפל, Defluxions of dense Air. D. 128. 136. 167. 150.

ערע, a Light, or Fire shining. D. 101. 502,3. Moth. E. 149.

ערע, to do. D. 107. 266. Q. 12.

ערע, Smoak. D. 194.

ערע, Tep. Rich. Q. 69.

ערע, to shine. D. 101. 502. G. 287, 8.

ערערת, the shining Circulators. D. 499-508. G. 286.

ערמה, Now, at length. K. 354.

ב

בְּנֵי, Arab. To give a Scent. D. 174.

בָּן, Light, Beauty. E. 254. F. 200. K. 47. 233. M. 135.

בְּנֵי,

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- בֹּקֶר, to break to pieces. D. 401.
- פָּטוּר, to open. E. 98. M. 124. פָּטוּר, 233.
- פָּחוֹת, unstable. I. 8.
- פְּלָא, an Agent that acts in an invisible Man-
ner. E. 38. F. 167. I. 19. 22.
- פְּלִגָּה, to divide. D. 235. E. 135.
- פָּלָט, the Deliverer. G. 476. 534.
- פָּלָץ, Concussion. Trembling. G. 461.
- פָּלַשׁ, to gather by rolling, as a Snow-ball.
D. 126. 265.
- פָּנָה, Perhaps. K. 354.
- פָּנָה, to turn. D. 165, 9. 254, 5. E. 165. G.
123. I. 129. 174.
- פָּנִים, Faces, Persons. A. 9, 10. D. 165. I.
129. K. 330, 1. 420. M. 125. 229.
- פָּנִינִים, the Loadstone. G. 123.
- פָּסָח, to halt. The Passover. E. 228. M.
301, 2.
- פָּסֵל, to form or carve an Image. G. 291.
N. 268.
- פָּעָר, to open. G. 331. 463.
- פָּצָץ, to make a Way to escape; break
forth. G. 535. N. 386.
- פָּקָד, to visit. N. 107.
- פָּקָד, a Gourd. N. 289. M. 228.
- פָּרָה, Increase. I. 233. פָּרָחוֹת, distinct.
I. 374.
- פָּרָת,

INDEX to Hebrew Words.

- פָּרֹחַ, to blossom. a Flower. D. 360. Q. 73.
פָּרָעַ, E. 249. M. 232.
פְּרִזֶּם, Break. Destroy. N. 316.
פָּרָשׁ, to spread abroad. Horseman. D. 115.
 235.
פָּשָׁע, N. 332.
פָּתָח, To deceive, entice. E. 176.
פָּתָח, to open. G. 330. Carvings. M. 234.
 N. 362. Q. 11.

צ

- צָבָא, Host or Army. D. 96,7. 101. E.
 282. F. 69—73. G. 140. 321. H.
 260. P. 42.
צָבָה, to swell. F. 69. G. 141. צָבֵי, Beauty.
 E. 120.
צָדָקָה Just. C. 30. I. 186. 207. M. 321.
 קָדָשָׂה, the Justifier. M. 97.
צָהָר, Oil. Mid-day. E. 217. M. 110,19.
 151. N. 134.
צָוֹר, to environ, bind close. D. 134,6. 328.
 D. 415,6. H. 211.
צָוֵץ, to press, bind fast. D. 137—42. 194.
 311. 327.
צָחַק, to laugh, play. D. 274. 418.
 צִיהָוב, the Gold round the Neck of a Pi-
 geon. D. 391.

E

צִיּוֹן,

INDEX to Hebrew Words:

- צִיּוֹן, Sion. I. 170. 216.
צָלֵם, an Image. Shadow. D. 123. צָלָמוֹת, the Shadow of Death.
צָלַע, Rib. Side. Lame. N. 61.
צָמָה, Sprout, shoot up. E. 119. M. 97. 221,2.
מְצַנְפָת, a Mitre. M. 234. Q. 31.
צָעַד, a Taker of Captives. D. 283. I. 211. 349. M. 56. 231. צָעָדִים, M. 208. 231.
צָעִים, Flowers. E. 98,9. M. 124. 227.
צָעֵת, M. 235. 384.
צָפָה, To look, observe, cover. Q. 36,7,9.
צָפָן, the Covering of the Heavens. G. 547. Q. 39..
צָפֵר, to fly, shoot forward as a Bird does, a Crown. F. 200.
צָרֶר, Some Thing bound hard. D. 129. 135,6. 328,9.
צָרָעָה, Exaltation, a Tower. D. 193.

כ

- קָבֵל, Darkness. D. 128.
קָרָח, Burning. D. 399.
קָרְבָּן, First. East, D. 117. I. 362,72. K. 123. 356.
קָרָק, Cold. Blackness. D. 129. 130. N. 375. שָׁקָר,

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- קָדֵשׁ**, separate, holy. E. 137. K. 324. M. 127—34. קָדְשׁ הַקָּדְשִׁים, the holy Place of the holy ones. K. 416. M. 211—7. N. 99.
- קֹם**, to rise, stand up. מָקוֹם, Place, Substance. D. 194. 310. 481. 530. E. 203. I. 352. K. 374. M. 96, 234. N. 318, 56. P. 44. Q. 40. 80.
- קָרֶן**, Thorns. The End. E. 192. 220.
- קָרֵחַ**, Dispersion, as of Rays. I. 28.
- קָטָן**, Small, inferior. D. 439.
- קָטָר**, Vapour. D. 145. M. 312.
- קַיִם**, Summer. E. 221. G. 276. 440.
- קָלַח**, Levity. Malediction. F. 107. I. 7.
קָלָל, I. 7. 351.
- קָנַפְתָּ**, Coagulate, condense. D. 125.
- קָצֵיר**, Harvest. E. 221.
- קָרָא**, to call. A Partridge. K. 145, 6. 283.
- קָרַב**, to approach, come close to. I. 388, 391, 2. M. 272. N. 386. קָרְבָּן יְהוָה, the Conflict of Jehovah. M. 272.
- קָרַן**, to project in Rays. D. 507—11. G. 286, 7. Q. 33.
- קָרֵר**, Cold. D. 130.
- קָרֵשׁ**, to condense. D. 125.
- קָשָׁת**, Stiff. M. 232.

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ה

רָאַת, to see. E. 122. Hawk. 149. F. 127. L. 91. יְהוָה יְרָאֵת, F. 153. רָאֵי, a Telescope of melted Metal. D. 140, i.

רָאֵשׁ, the Head, First, or Chief. D. 304. K. 303. 347. רָאֵשׁוֹן, First in Time. K. 303. 347. רָאֵשִׁית, Chief of what the Text is speaking of. K. 303. 346. M. 15. מְרָאֵשֶׁת, K. 374, 5.

רָבָּה, great in every respect. I. 119—21. 382, & seq. K. 369. רָבָּב, I. 381.

רָבָּה, G. 145. רָבָּב, my great one. I. 382. רָבִּים, the great ones. G. 359. I. 119—21. 382. & seq. K. 369. M. 15.

רָגֶב, a Lump, or Grain. D. 142. 327.

רָגֶל, the Foot. K. 172.

רָגַם, to stone. D. 317.

רָגַע, to rest, pause. A Moment. N. 326.

רָדָה, to rule, bring down. N. 320—86.

רָוָה, to water, moisten. E. 136,

רוּחָה, the Spirit. A. 12. 85. D. 117. 121—4. 150—6. 167. F. 214—7. K. 221. M. 16. N. 32. P. 32.

רוֹטָה, to be lifted up. D. 105. 315—9. G. 426.

רָחֵב, Space, or Dimension, Room. D. 152. G. 325. H. 165.

רָחָם,

INDEX to Hebrew Words.

- רָחֵם, the Womb. Tenderness. I. 384. N. 250.
- רְחַזֵּק, to brood upon. A. 12—16. D. 150-2. 164.
- רְחֹזֶץ, to wash. E. 209.
- רָחֵק, to defer. distant. N. 350.
- רְחֹשׁ, to boil. N. 340.
- רִיחָה, Vapour. M. 380. P. 74.
- חֵיק, Emptiness, or Vacuum. E. 16. I. 232.
- רְכֵב, to ride, preside, drive. D. 113—6. 294,5. 521.
- רְמָה, to elevate, project. D. 270. 315—9. G. 91. N. 389. Q. 35. רְמָן, a Pomegranate. A God. G. 305. Q. 66.
- רָנָה, to shout. jump up and down. D. 260. 525. N. 336.
- רָע, to break the Order of Things, as Sound does that of the Air, and so variously applied. Evil. E. 129. 229. N. 92,3. A Shepherd. M. 96. 326. רְעֵנָן, Shadow. E. 254.
- רְיעֵשׁ, to shake. N. 360.
- רְפָא, to heal, repair. I. 156. K. 372,3. M. 147. N. 338.
- רְצִיזָה, to break to pieces. D. 179. 400.
- רְקִמּוֹת, Needlework. N. 256.
- רְקֻעַ, to expand. D. 264.

רְקִיעַ

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עַקְוֹעַ, Expansion, 266.

רָשֵׁעַ, Rester. N. 332.

שׁ

שָׁאֵף, Attraction. D. 168. 400. 529.

שָׁבֵל, Cybele. D. 378.

שָׁבַת, to cease. Rest. The Sabbath. D. 96,
107. H. 36.

שָׁבֵט, Branch, Tribe. F. 5. Sceptre. M. 96.
E. 15. N. 257. שָׁדִים, F. 134. G.
489.

שָׁלֹךְ, cover in Darkness. E. 187.

שָׁחֲקִים, Airs in Conflict. D. 46. 265—6,
& seq.

שָׁחָר, Hind. F. 49.

שָׁחָת, Corruption. N. 326.

שָׁמֶה, Declination. D. 410.

שָׁלִיחָה, I. 29. 213.

שָׁכָה, Picture. D. 389.

שָׁכֵב, to lie down, a Bed. N. 338.

שָׁכֵל, Overseer, applied to the Holy Ghost,
N. 304.

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